Investigation of the links between psychological ill-health, stress and safety

Prepared by **The Keil Centre** for the
Health and Safety Executive 2006

RESEARCH REPORT 488

Investigation of the links between psychological ill-health, stress and safety

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The impact of psychological ill health and stress at work is gaining increasing attention from both researchers and organisations. The last few years have seen a sharp increase in interest in how this impacts on the individual's wellbeing and performance in a work context. At the same time, the UK has also seen an increase in attention to the impact of human factors on accidents and safety-related behaviours, as a growing proportion of accidents and incidents are caused by human behaviour, rather than technology and equipment.

Investigating the causes of accidents, incidents and unsafe behaviour, including understanding the possible influence of psychological ill health, has become a priority. This understanding should address both whether experiencing psychological ill-health or stress at work can impact on individuals' safety behaviour and also how the presence of potential sources of psychological ill-health or stress at work may affect safety performance.

This report presents evidence to contribute to this understanding; it will focus on the relationship between psychological ill-health, stress and safety in a work context.

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EXECUTIVE SUMMARY

This report presents evidence to help understand how experiencing psychological ill-health at work (including stress, anxiety, depression and related symptoms) can affect performance of individuals in the work setting, and also how this could influence safety performance at work.

This project has been co-sponsored by the Health and Safety Executive (HSE) and an Industry Partner from the oil and gas industry, and draws upon evidence presented in the literature on psychological ill-health, supplemented by analyses of industry databases of incidents and interviews with investigators and personnel who have experienced the effects of stress, anxiety, depression and related symptoms first-hand.

Psychological ill-health related problems appear to be a significant feature of UK working life with up to 30% of the working population experiencing psychological distress, and around 20% reporting that they find their work very or extremely stressful. This means that, if there were clear negative effects of psychological ill-health on individual's safety, this could be a significant issue for UK business.

Research suggests that longer-term psychological ill-health such as clinical anxiety and depression has a significant negative impact on performance; in the incidents reviewed, ill-health had resulted mostly in withdrawal from work. In other cases the individual was also taking medication and it was impossible to separate the effect of medication from the effect of ill-health. It is also the case that treatment of psychological ill-health and related symptoms tends to be addressed independently of incident investigations in most organisations (e.g. by occupational health specialists). It is therefore possible that incident investigators are not sufficiently equipped to gather evidence on the presence of psychological ill-health. It is equally possible that the individuals concerned may not report their symptoms because they are not aware that there could be an impact on safety performance, or because they fear the potential consequences of doing so.

Stronger evidence exists for the impact of frame of mind on safety. This means that the way people are thinking and feeling can cause or contribute to them having an accident, behaving unsafely or committing an error. The effect of some of these frames of mind was similar to the effect of longer-term psychological ill-health. This means that the performance of someone who is feeling anxious on a particular day, for example, is affected in a similar way to that of someone suffering from clinical anxiety. In addition, the presence of some of these frames of mind was not necessarily a sign of ill-health but could be considered a natural reaction to the circumstances the individual was in.

In summary, the research highlighted the following effects in a non-clinical population:

Feeling…	More likely to …
Stressed	- Be distracted by other thoughts
	- Suffer from possible actual diminished ability to control thoughts and actions
Anxious / Worried / Tense	- Attend to fewer sources of information
	- Be more prone to distractions
	- Find it harder to focus on a task
	- Over-react
Depressed / Low / Tired	- Find it harder to focus on a task
	- Be less interested and less motivated
	- Prefer to avoid interacting with others
	- Find you memory is affected
Angry	- Act aggressively
	- Commit a violation of procedure
Frustrated	- More likely to act without due care

This research also identified common risk factors for psychological ill-health and human error, and that these common risk factors are also associated with common root causes of accidents. Therefore, stress risk assessments, incident investigations and human error analyses have the potential to inform of potential safety impacts in other areas.

A series of recommendations were made relating to the following topics:

- Developing an integrated approach to health and safety covering work-related stressors and the potential causes of accidents and errors;
- Ensuring the effective management of distressing events at work;
- Considering the impact of poorly managed organisational change and job uncertainty on the psychological health and safety of employees;
- Improving the knowledge and skills of drivers regarding the effect of frame of mind on driving ability;
- Fostering a supportive culture that encourages open reporting of psychological ill-health and related symptoms;
- The benefits of more regular stress risk assessment;
- The importance of task-focused risk assessments including frame of mind;
- Understanding and responding to observed symptoms of psychological ill-health or frame of mind;
- Improving self-awareness of individuals.

Report Overview

The report is divided into seven sections, with each section combining a review of evidence and an overview of implications for safety.

Section A   Introduction

Outline of the project's background and main partners. Project's key objectives are outlined as well as the definition of psychological ill health.

Section B   Psychological Ill Health & Stress: Prevalence

Review of national databases to establish types of illnesses commonly associated with psychological ill health and stress and their prevalence in the UK working population.

Section C   Psychological Ill Health & Stress: Impact on behaviour

Literature review of existing knowledge of how psychological ill-health and stress affect performance.

Section D   Psychological Ill Health: Evidence from Accidents

Review of accidents caused by psychological ill–health and stress to further contribute to the understanding of how psychological ill-health affects safety.

Section E   Stressors and causes of accidents and errors

A review of the overlap between sources of stress and causes of accidents and human error.

Section F   Conclusions

Review results of all sections of the report and of the resulting implications for safety performance.

Section G   Recommendations

SECTION A - Introduction

A. 1 PROJECT BACKGROUND

The impact of psychological ill health and stress at work is gaining increasing attention from both researchers and organisations. The last few years have seen a sharp increase in interest in how this impacts on the individual's wellbeing and performance in a work context. At the same time, the UK has also seen an increase in attention to the impact of human factors on accidents and safety-related behaviours, as a growing proportion of accidents and incidents are caused by human behaviour, rather than technology and equipment.

Investigating the causes of accidents, incidents and unsafe behaviour, including understanding the possible influence of psychological ill health, has become a priority. This understanding should address both whether experiencing psychological ill-health or stress at work can impact on individuals' safety behaviour and also how the presence of potential sources of psychological ill-health or stress at work may affect safety performance.

This report presents evidence to contribute to this understanding; it will focus on the relationship between psychological ill-health, stress and safety in a work context.

A. 2 PROJECT PARTNERS

This project has two main stakeholders: (1) the UK Health and Safety Executive (HSE) and (2) an industry partner, from the oil and gas sector:

A. 2.1   Health and Safety Executive

In 2000, the Health and Safety Commission (HSC) set out a long term occupational health strategy for England, Wales and Scotland for improving psychological health at work. This included challenging targets for the reduction of incidence in work-related ill-health and improvements in rehabilitation.

Tackling psychological ill-health at work was acknowledged as a key part of achieving the targets set out in the HSC's strategy. The Health and Safety Executive (HSE) has therefore funded extensive research in the area of psychological ill-health and work-related stress in particular, resulting in the publication of guidance and tools to support employers wanting to take action in this field, for example the Management Standards.

The majority of research in this field has focused primarily on the impact on the individual (e.g. common symptoms) and on the organisation (e.g. the impact of sickness absence). There is now interest in investigating the impact on safety more specifically.

The expected benefits for the HSE are a further understanding of how psychological ill health can impact on safety and some suggestions about how this knowledge could be applied to bring about a reduction in injuries, absence and ill health at work.

A. 2.2   Industry Partner

The industry partner is an international energy company which operates in a number of high hazard environments, including offshore oil and gas extraction. The company has a keen interest in improving health and safety performance across its whole operations.

As with many other organisations in their field, 'human behaviour' is now a major cause of accidents within this company. The company's accident investigation system includes a reference to psychological ill health or stress, however, it is acknowledged that the impact of psychological ill health on safety is not clearly understood. This could mean that the organisation is not doing all it could to effectively control this risk to employee health and safety.

The industry partner is keen to better understand how psychological ill-health and stress can impact performance and to apply this understanding to improving their health and safety performance.

A. 3 PROJECT OBJECTIVES

This project aims to fulfil the aims of the two main stakeholders: the Health and Safety Executive and the industry partner. The key objectives are to:

- Understand how psychological ill health and stress in an individual can affect safety by reviewing:
    - Relevant academic studies;
    - Recent incidents or accidents that were caused or contributed to by the individual's psychological ill health or stress;
- Outline the key conclusions and implications of this knowledge for industry.

The project reviews evidence from a wide variety of sources including: laboratory and industry-based research studies, accident investigations and interviews with Subject Matter Experts (SMEs). In all instances, efforts are made to explain rather than purely report the association between psychological ill health and safety.

A. 4 DEFINITIONS

The term 'psychological ill-health' is commonly used to cover a broad range of feelings: from experiencing minor symptoms for a short period of time, to suffering longer-term chronic and severely disabling mental disorders. To assist understanding, this report will distinguish between the two experiences where possible.

The definition of 'psychological ill-health' adopted in this report is taken from the Diagnostic & Statistical Manual of Mental Disorders (DSM-IV-TR), a diagnostic manual used in clinical settings in the UK to identify and diagnose specific mental disorders. The DSM-IV-TR states that, in order to be classified as a mental disorder, a person's symptoms must not be considered a natural reaction to the events that the person has been exposed to and should be:

> *"a clinically significant behavioural or psychological syndrome or pattern that occurs in an individual and that is associated with present distress (e.g. a painful symptom) or disability (e.g. impairment in one or more important areas of functioning) or with a significantly increased risk of suffering death, pain, disability or an important loss of freedom."*

This report will contrast this type of occurrence with everyday experiences of possible symptoms of psychological ill-health that, whilst linked to the major disorders, are not of a severe enough nature or long enough duration to satisfy the criteria for clinical diagnosis; these will be referred to as an individual's 'frame of mind'. For example, the report will distinguish between feeling anxious (frame of mind) and the experience of clinical anxiety (psychological ill-health) – see also Glossary.

In addition, the report will also examine the topic of stress at work. There is considerable debate over the exact meaning of the term 'stress'; a variety of definitions are available and in common use[1] but the boundary between stress and mental disorder is often blurred. Excluding references to stress caused by the reaction to a single, often extreme, event (e.g. Post Traumatic Stress Disorder) the DSM IV-TR refers to what is commonly called 'work-related stress' as an Adjustment Disorder:

> *"The psychological response to an identifiable psychosocial stressor or stressors that results in the development of clinically significant emotional or behavioural symptoms."*[2]

The symptoms develop within 3 months of exposure to the stressors and should abate within 6 months of termination of the stressor. The symptoms are considered 'clinically significant' if they produce either more distress in the individual than would usually be expected given the cause or significant impairment in social and occupational functioning. Any experience that met the above criteria would, following the definitions adopted in this report, be considered to be psychological ill-health.

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[1] *For example, 60 definitions are cited in Reference 1*
[2] *Reference 2*

In contrast, the Health & Safety Executive provide a definition of stress as follows:

> *"The adverse reaction people have to excessive pressure or other types of demand placed upon them"*[3]

As the HSE points out, this experience cannot be considered one of actual psychological ill-health, though, if prolonged or particularly intense, it can lead to increased problems with ill-health. Therefore, following the definitions adopted in this report, experiences of this type will be referred to as a 'frame of mind'.

This report will therefore distinguish, where possible, between instances where the term 'stress' is used to refer to 'psychological ill-health' and instances where it is used to refer to an individual's 'frame of mind'.

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[3] *Reference 3*

SECTION B - Psychological Ill-health & Stress: Prevalence

This section provides current estimates for the prevalence of psychological ill-health in the UK population and, more specifically, in the UK working population. Prevalence will be expressed as the percentage of a disease or disorder present in a specific population at an identified time.

B. 1 THE UK GENERAL POPULATION

There is some variation in the different estimates of the extent of psychological ill health in the general UK population, depending on how it is measured. Some examples of incidence rates are reported below from a recent report from the Mental Health Foundation[4]:

- 1 person in 4 will experience some kind of mental health problem in the course of a year;

- 10-25% of the general population annually present with mental health problems, usually in primary care settings; amongst these, 2-4% will suffer from a severe mental illness;

- Estimates of the number of people with severe and enduring mental health problems vary from 0.3 to 1.5% of the adult population (it is unlikely that people who fall into this category would be attending work).
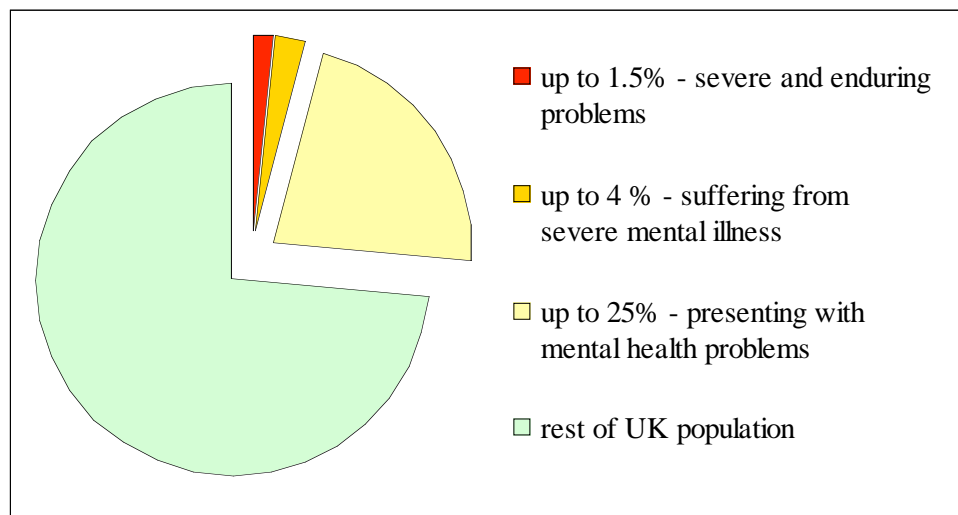
B.1 - Figure A: Extent of Psychological Ill Health amongst the UK Population

The most commonly experienced psychological ill-health related problems are classified as 'neuroses': most commonly anxiety and depression. The following are estimates of prevalence for the UK population:

- 1 in 6 people experience some form of 'neurotic health problem' over the course of a week – the most common 'neurotic disorders' were anxiety and depressive disorders[5];

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[4] Reference 4
[5] Reference 4

- Point prevalence for Major Depressive Disorder varies from 5% to 9% in women and 2% to 3% in men; the prevalence for Generalised Anxiety Disorder is approximately 3%; [6]

- More than 1 in 10 people are likely to have a 'disabling anxiety disorder' at some stage in their life.[7]

B.1.1 Gender Differences

Gender differences in reporting of psychological ill-health are fairly consistently replicated. Official figures for England suggest a higher prevalence of mental illness in women (20%) than in men (14%)[8]. Recent figures for Scotland also show a higher prevalence of common neuroses in women, as in the table below[9].

B.1 – Table A: Prevalence rates for anxiety and depression in Scotland 2003/04

	Anxiety	*Depression*
Males	3.87 %	2.22 %
Females	8.47 %	6.86 %

Several factors should be taken into consideration when interpreting these figures and it is likely that both social and biological factors contribute to the higher prevalence of neuroses in women: for example, there is evidence that they could be influenced by a different attitude to reporting: i.e. women are more likely to visit their General Practitioner and report symptoms than men. The initial interpretation that women suffer more from psychological ill-health is also not precise as men are much more likely to develop dependencies (alcohol and drugs) and are also more likely to be diagnosed with a more serious psychotic illness[10].

B. 2 THE UK WORKING POPULATION

Overall, 85% of people with serious psychological ill-health problems are economically inactive, therefore not currently in employment. It is likely that the majority of these cases will be sufferers from more severe psychotic illnesses. The remaining 15% will be at work, or currently employed, and are more likely to suffer from common neuroses: depressive and anxiety disorders[11].

It is worth noting that evidence shows that both the physical and psychological the health of unemployed people (i.e. people not in work but actively seeking it) is, in general, worse than that of people who are employed; some studies also show that this difference may actually be caused

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[6] *Reference 2*
[7] *Reference 4*
[8] *Reference 4*
[9] *Reference 5*
[10] *Reference 4*
[11] *Reference 4*

by the unemployment itself (Warr, 1987a[12]; Warr, 1987b[13]). The ill-health effects of unemployment appear to be similar to those experienced by SOME PEOPLE in employment (e.g. increased anxiety and depression), but this report does not attempt to contrast the two experiences. This report concentrates solely on health of people who are currently in employment.

B.2.1 Psychological ill-health at work

Estimates of the prevalence of psychological ill-health at work also vary significantly depending on the way that this is measured. Some relevant findings are reported below:

- **16 to 31% report symptoms of psychological distress**

This is as classified by responses to the General Health Questionnaire (GHQ)[14], a commonly-used instrument to measure prevalence of the symptoms of minor psychiatric disorder in the general and working population. The GHQ asks respondents to indicate how many symptoms of minor psychiatric disorder they have experienced recently. Reporting 3,4 or more symptoms indicates minor psychiatric disorder or psychological distress. The GHQ bench-marking manual suggests that incidence of 'minor psychiatric disorder' or of a high number of symptoms of psychological distress varies between occupational groups; the table below shows the three groups with the highest incidence in the UK[15].

B.2 – Table A: Incidence of minor psychiatric disorder by occupational group

	Occupational Group	*% incidence rates*
Top 3	Professional	31.4
	Managers & Administrators	31.1
	Personal and Protective Services	28.6

- **557,000 people believe they are suffering from psychological ill-health**

This is data reported by Health and Safety Executive (HSE) for self-reported work-related illness for people who have been in employment in the previous 12 months. The most recent survey was carried out in 2003/ 4 [16] and indicates that an estimated 557,000 people believe they are suffering from work-related stress, depression or anxiety that was caused/ made worse by their current or past work. Of these, 46% (254,000) first became aware of their symptoms in the previous 12 months – just under 1% of the UK working population for that same time period.

- **6,500 new cases per year of work-related psychological ill-health**

This data comes from schemes for voluntary reporting for specialists doctors, recently united under THOR, The Health and Occupation Reporting network. The annual incidence in Britain in 2003 was approximately 6,500 new cases per year (approx 0.2% of the current UK working

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[12] *Reference 49*
[13] *Reference 50*
[14] *Reference 6*
[15] *Benchmark data Reference 7*
[16] *Reference 8*

population).   Overall, data from THOR and related schemes indicates reporting levels rose between 1995 and 2001 but have since plateaued. Figures from THOR should be considered underestimates as they are based on data from in-company physicians, not available in all work-places, and specialists doctors, who will only see the more severe cases.
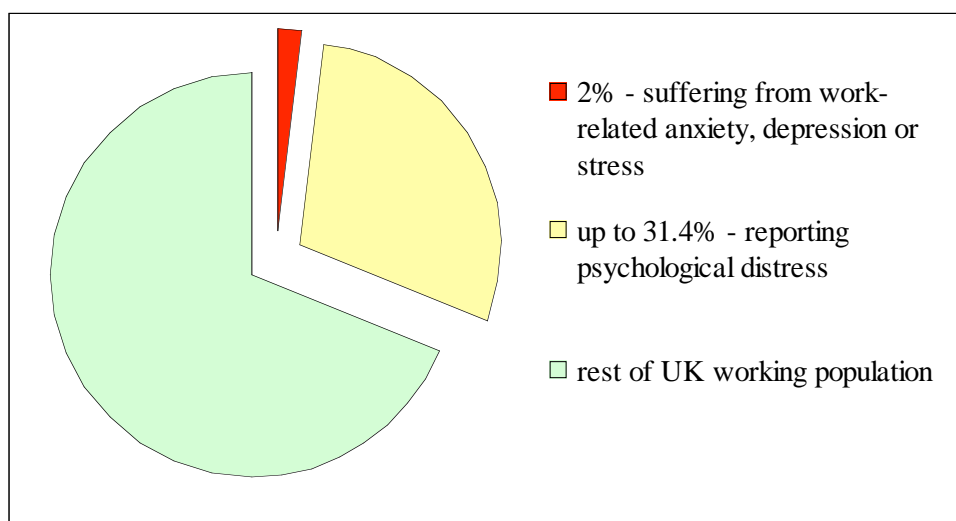
B.2 - Figure A: Extent of Psychological Ill Health and related problems amongst the UK Working Population

B.2.2 Stress at work

In the UK, the focus on psychological ill-health at work has been dominated by attention to 'stress'. As discussed in the previous section (see also Glossary), this term can be used to describe both an individual's frame of mind as well as suffering from a clinical disorder or psychological ill-health as defined in the current report. The interpretation of research into the extent of 'stress' in the UK working population is significantly limited by the lack of clear operational definition of this concept, as will be further discussed below.

Research conducted by the Health & Safety Executive reports that in 2001/02, over half a million people in Great Britain (approx 2% of the UK working population) believed that they were experiencing 'work-related stress' at a level that was making them ill[17].

The extent of the experience of stress interpreted as 'frame of mind' can be suggested by the single item measure that has been used in Health & Safety Executive research with a working population. Responses to this item allow a classification of individuals were into 'High' and 'Low Stress' groups; the 'High Stress' groups are more likely to report the following[18]:

- Anxiety and depressive symptoms;

- Symptoms of psychological distress;

- Taking prescribed anti-depressants;

- Behaviours that could be detrimental to health: e.g. more frequent alcohol consumption.

Responses in the last few years to this single-item measure are compared below[19][20]:

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[17] *Reference 8*

[18] *Reference 9*

[19] *Data for 1998 & 1999 – Reference 9*

B.2 – Table B: Percentage High Stress 1998 to 2005

Year of Survey	Sample	% High stress
1998	4044	18.5
1999	1854	17.1
2004	1693	16.5
2005	1474	15.2

The table below shows the three groups with the highest percentage of staff in the 'High Stress' group in the UK[21].

B.2 – Table C: Percentage High Stress by Occupational Group

	Occupational sector	% High Stress
Top 3	Teaching	41.5
	Nursing	31.8
	Managerial	27.8

This single-item measure of stress at work is used as a simple way of gauging levels of stress at work, however it is not clear what percentage of the individuals in the high stress group are experiencing symptoms of a severity and duration that would indicate actual psychological ill-health. This means that it is difficult to determine the proportion of people in the high stress group who are experiencing a mental disorder as classified by DSM-IV-TR.

B.2.3 Psychological ill-health absence

Reports on psychological ill-health at work tend to also consider the extent of ill-health related absence, partly as a measure of the severity of the symptoms experienced. Recent reports indicate that this is a significant feature of UK life:

- 12.8 million working days are lost a year due to work-related stress, depression and anxiety and 28.5 average days lost per case for stress, depression or anxiety (data for 2003/04); [22]

- 15% and 26% of days of certified incapacity in men and women respectively are accounted for by mental health problems (data released in 1998);

- 16% of managers had taken some time off work because of stress during the last 12 months[23].

These results show that a significant issue associated with psychological ill-health and related problems at work is absence, though these rates cannot automatically be used as a measure of

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[20] *Data for 2004 & 2005 – Reference 10*
[21] *Benchmark data – Reference 9*
[22] *Reference 8*
[23] *Reference 11*

severity of ill-health. These figures may also be an under-estimate as stigma associated with admitting psychological ill-health may cause individuals to report physical ill-health as the main cause of absence; also, there is some evidence that musculoskeletal disorder symptoms, for example back pain, are accentuated by suffering from depression and anxiety; some absence due to the former may therefore also be associated with psychological ill-health.

B. 3 CONCLUSIONS

In conclusion, the figures above show that psychological ill-health related symptoms are fairly common in the UK population, with a sub-set of people presenting symptoms at a level consistent with a clinical diagnosis of mental disorder (psychological ill-health as defined in this report). The most common ill-health problems are neuroses such as anxiety and depression, and there is higher reporting in women.

Analysis of the data suggests that, at any point in time, there will be a significant number of people at work who are experiencing psychological ill-health and related symptoms, though the figures vary significantly depending on how these problems are measured. Again, the most commonly experienced problems will be anxiety and depression. Worryingly, some estimates indicate that up to 30% of people are reporting symptoms of psychological distress at work and that on average 20% of the working population finds their work very or extremely stressful, which could make them more likely to suffer from related psychological and physical ill-health.

The data for the UK working population, however, has clear limitations. The majority of the data is self-report, i.e. based on how individuals say they are feeling, and only rarely further consolidated by an examination or diagnosis by a trained professional. The data tends also to be vague in terms of the severity of the symptoms experienced: for example, it is difficult to determine how many of the people who say they are stressed are experiencing significant psychological ill-health compared to having a difficult day or week (stressed 'frame of mind' – see Glossary).

Psychological ill-health-related absence also seems a significant feature of UK working life. However, without distinguishing between short- and long-term absence, it is difficult to understand what percentage of absence is associated with significant psychological ill-health.

In conclusion, psychological ill-health related problems appear to be a significant feature of UK working life, although the data available does not allow clear conclusions to be drawn regarding severity of symptoms experienced. This means that, if there were clear negative effects of psychological ill-health on individual's safety, this could be a significant issue for UK business.

SECTION C - Psychological Ill-health & Stress: Impact

C. 1 STRESS & PERFORMANCE

As mentioned previously, the term 'stress' is commonly used to refer to psychological ill health-related symptoms of varying degrees of severity.

The clinical diagnosis for stress-related ill-health (see Glossary) known as Adjustment Disorder refers to clinically significant symptoms, significant distress and impairment in functioning. The predominant symptoms are: anxiety and/or depressed mood and/or conduct disturbance (e.g. breaking societal norms). The list of types and severity of symptoms that constitute the experience of 'stress at work' (not psychological ill-health) are varied; the following are commonly reported[24]:

- Physical ill health symptoms
    - high blood pressure, recurring stomach trouble/ indigestion, headaches, recurring back ache; recurring health problems; chest pains etc.
- Psychological ill health-related symptoms
    - depression, nervous trouble/ anxiety

It is reasonable to assume that performance will be affected if someone were experiencing these symptoms. This report will concentrate on the psychological ill-health related symptoms and how these are likely to affect performance and safety.

C. 1.1 Stress & depression and anxiety

Depression and anxiety, in varying forms of severity, are associated with both stress-related psychological ill-health and the experience of 'stress at work'. In contrast to 'stress', the concepts of depression and anxiety are more clearly defined, for example, there are clear diagnostic criteria for disorders associated with both. The report will therefore consider these in some detail in the following sections of the report. It can be assumed that the conclusion drawn for anxiety and depression will also related to someone who reports suffering from 'stress' if anxiety and/or depression are the main symptoms experienced.

C. 1.2 Stress & Burnout

When discussing work-related stress, attention needs to be paid to 'burnout', a syndrome that is associated with stress at work but that has clearer diagnostic criteria. There is still some debate about whether burnout is itself a form of ill-health or whether it causes mental dysfunctions. Research supports the conceptualisation of the burnout experience into three dimensions[25]:

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[24] for example: Reference 9
[25] Reference 12

Exhaustion	Overwhelming feeling of fatigue and exhaustion etc;
Cynicism	Detachment from work; loss of idealism about own work; withdrawal; irritability etc;
Inefficacy	Feeling of reduced accomplishment, low morale etc.

The research into the effects on performance has identified two main issues associated with, though not necessarily caused by, burnout:

Decline in job performance	-	Increased self-report cognitive failures: e.g. slips of action, inattentiveness;
	-	Greater distraction;
	-	Greater errors of inhibition (not controlling an incorrect response);
Increase in withdrawal	-	Increase in absence from work; intention to quit etc.

There is a suggestions that the effect on job performance is related to reduced cognitive functioning, possibly related to a decrease in executive control over information processing, this means the individual has less control over what they pay attention to and their actions[26].

C. 1.3 Stress & Accidents

The research investigating the relationship between 'stress' and accidents is not large, but the findings seem to be relatively consistent.

A large-scale, longitudinal study carried out in the early 2000s indicated that people reporting high levels of stress did report a higher occurrence of accidents at work than those reporting low stress scores; this difference was significant for accidents at work but not in the home. However, no conclusions can be drawn as to why reporting 'high stress' could lead to accidents and caution in generalising these results is advised by the authors themselves due to the low number of responses[27].

A recent review of individual factors influencing driving behaviour also looked at the relationship between stress and road traffic accidents[28]. Several studies are reported where high stress was associated with higher rates of accident involvement and riskier driving behaviour. Some explanations for this association are suggested; including the following:

- In one study, high stress individuals report greater financial stress, leading the authors to suggest that this may be the critical factor in determining why reporting 'stress' leads to greater involvement in accidents;

- In another study, high stress individuals made more errors and tended to speed more often; the authors suggest this could be due to the 'stressed' individuals feeling more rushed;

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[26] *Reference 13*
[27] *Reference 9*
[28] *Reference 14*

- In another study major life stress was found to be linked to transient depression; the authors therefore suggested that this depression could be the significant factor in understanding higher levels of crash involvement;

All of these studies are clearly limited by the lack of a clear definition of 'stress'.

C. 1.4 Conclusions

It is commonly agreed that people who report stress are suffering from symptoms of anxiety and/ or depression. The evidence of the effect on performance of both of these forms of psychological ill-health will be reviewed in the next section.

There are objective difficulties in reviewing other evidence of the effect of stress on performance due to the lack of clear operational definitions for 'stress' and a difficulty in understanding what individuals who report being 'stressed' are actually feeling.

Some speculative conclusions can be drawn from the existing research on the impact of burnout on performance and of 'stress' on accidents. These individuals' performance seems to be negatively affected due to diminished attention to tasks, possibly linked to:
- Distractions by other thoughts, aggression or feeling the need to rush;   and/ or
- An actual diminished ability to control thoughts and actions.

C. 1.5 Implications for Safety

It is difficult to draw specific implications for safety when the conclusions drawn are only speculative. However, there does seem to be evidence that people who report feeling 'stressed' are more likely to be involved in a driving accident. Further research in this area needs to isolate specific factors that can explain this increased risk due to feeling 'stressed'. This will then help organisations focus their efforts to ensure these factors are avoided where possible, minimised or controlled.

In addition, organisations can concentrate their efforts on helping employees become discriminating users of the term 'stress', e.g. clarifying whether they are referring to severe or transient symptoms. Organisations can also question carefully the symptoms experienced by individuals who report being 'stressed'; this may help to clarify, for example, understanding whether the individual is experiencing burnout or clinically significant symptoms of anxiety. This greater clarity of symptoms will lead to a better understanding of the likely impact on performance and will help to design and implement more effective interventions.

From the evidence presented in this section, organisations need to be vigilant for the symptoms of burnout in individuals and ensure that they are removed from safety critical tasks.

C. 2 ANXIETY & PERFORMANCE

One of the most common forms of psychological ill-health and related symptoms in the UK working population is anxiety. This section will review evidence of the effects of clinical and non-clinical anxiety and their possible impact on safety.

C. 2.1 Clinical Anxiety

Anxiety is characterised by changes in the way the individual thinks, feels and behaves; anxiety is usually experienced in response to a perceived significant threat. There are a series of clinically diagnosable disorders that are associated with anxiety, some are characterized by an increase in worry over a specific object or event (e.g. phobias), others are more generic.

When diagnosing an individual with a Generalised Anxiety Disorder[29], clinicians would usually be looking out for the experience of uncontrollable, excessive anxiety and worry, occurring most days, for a period of not less than 6 months. The experience of the majority of the following symptoms, again on a regular basis for more than 6 months, is also expected:
- Restlessness;
- Being easily fatigued;
- Difficulty concentrating;
- Irritability;
- Muscle tension;
- Disturbed sleep.

A key to the diagnosis and the experience of anxiety is the individual's cognitive dysfunction - i.e. the experience of thoughts and reactions considered excessive - and their perceived lack of cognitive control – i.e. their perceived inability to control or manage these thoughts. This means that someone who is suffering from an anxiety disorder will have a tendency to interpret the world around them as much more threatening than others would see it and have great difficulty in controlling or dismissing these thoughts and feelings as unrealistic or over-blown.

Many people who suffer from anxiety report this lack of control over negative thoughts as the most disabling feature of the disorder. This can interfere with their ability to carry out activities that had in the past been straight-forward, such as answering the phone, driving short distances[30].

In addition, there is evidence to suggest that clinically anxious patients are 'biased' towards things around them that are threat-related, displaying a selective attentional bias towards threat-related things: for example, they may pay more attention to words that they connect with threat[31]. This selective bias has also been shown to affect memory and recall, with some researchers suggesting that people who suffer from anxiety have a 'negative memory bias', i.e. they will more easily recall things associated with the threat.

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[29] *Reference 2*
[30] *Reference15*
[31] *Reference 23*

Panic attacks, though not an expression of ill-health in themselves, can occur in the context of anxiety-related disorders. Panic attacks can be interpreted as a culmination of anxiety symptoms in a single severe event[32]. These attacks are often triggered by concerns about threats to the individual which escalate very rapidly into more extreme thinking, with intense physical symptoms such as: palpitations, sweating, trembling, shortness of breath, chest pain, nausea and dizziness. Attacks are significantly debilitating, i.e. individuals will find it either hard or impossible to continue their normal functioning.

C. 2.2 Anxiety in non-clinical population

The experience of anxiety in a non-clinical population is usually associated with a series of changes in both the way the individual is thinking (psychological or cognitive changes) and in the way they are feeling (physical changes). In someone suffering from an anxiety-related psychological disorder, these changes will be significantly debilitating, as mentioned above. However, the actual physical and psychological changes in themselves are not necessarily harmful; these characterise the way the body responds to threat and are meant to be adaptive, i.e. helpful in allowing a rapid, appropriate response to the threat itself. The two separate types of changes will be analysed separately below.

C. 2.2.1   Physical changes & performance

The physical changes associated with anxiety are linked to an increase in arousal. In this context the term arousal refers generically to the activation of the mind and body to respond to external events (see Glossary). These changes are commonly known as the 'fight or flight' response, an instinctive response that prepares the body either to flee from a threat or to defend itself against the threat[33]. The main changes are outlined in the table below:

C.2 - Table A: Symptoms of 'Fight-Flight' and main explanation

Change	*Results in:*
- Increased heart rate	- Pumping blood to muscles and brain
- Tensing the muscles	- Preparing body for physical activity
- Sharpening of the senses: e.g. dilation of pupils	- Increasing ability to detect information
- Sugar deposits released into the blood	- Raising energy levels
- Blood clots more quickly	- Lessening impact in case of injury
- Increased production of red blood cells	- Oxygenating the muscles
- Increased breathing rate	- Taking on more oxygen
- Digestion slows	- Blood transferring to more vital areas
- Increased perspiration	- Managing body temperature.

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[32] Reference 15
[33] See for example Reference 16

Though the 'fight-flight' response is helpful, there is a lot of evidence that shows that being exposed to both high and low levels of arousal can have a negative effect on performance. The most commonly-referred to analysis of this seemingly contradictory effect of arousal on performance is the Yerkes Dodson Law (1908)[34]. This stated that:

- There is an inverted U relationship between arousal and performance, with optimal performance at moderate levels of arousal

- The optimal level of arousal is inversely related to task difficulty

This means that some arousal is needed to increase performance but once this has increased beyond a certain point, performance will deteriorate rapidly, as depicted in the picture below. This also means that the harder the task, the lower the level of arousal needed to perform it optimally. This explanation has been very useful in describing how arousal shapes performance.
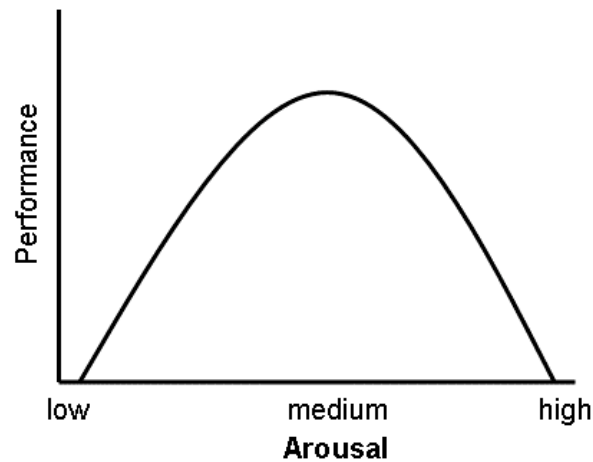
C.2 - Figure A: Illustration of Yerkes Dodson Law

A good example of how the Yerkes-Dodson Law works in practice is performance on vigilance tasks, reported in the table below.

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[34] *Reference 17*

C.2 – Table B: Arousal & Performance – Vigilance Case Study

Since World War Two, there has been extensive research into performance on vigilance tasks and specifically how they are affected by levels of arousal. Some examples are reported below.

Work on a simulated radar task revealed a drop in vigilance performance within a relatively short period of time[35]; researchers suggested that, as this task was very monotonous, the individuals' arousal levels dropped quickly after starting (e.g. they became bored) and this caused the drop in performance.

Due to the monotonous nature of many vigilance tasks, researchers then began to explore ways in which to optimise levels of arousal during task completion in order to avoid both under- and over-arousal. Some mixed results ensued: some researchers found that increasing levels of arousal worked only when levels of arousal were very low, for example in sleep-deprived subjects [36]. When levels of arousal were not low, increasing the level of arousal did not improve performance.

Other researchers suggested that presentation of a secondary task would help to increase levels of arousal, for example completing separate auditory and visual tasks at the same time[37]. Again, the results were mixed: the dual-task completion improved performance on simple tasks but degraded performance of complex vigilance tasks. One explanation for this could be that the level of arousal generated by the simple task is low, so additional arousal is beneficial to performance. For complex tasks the level of arousal is already high, and hence increasing it further is detrimental to performance.

Research has tried to find commonalities in the effects of high arousal on performance, though the effects above have not been found consistently across all types of performance. The most common effects found are[38]:

- Increased attentional selectivity (attending to fewer information sources)

- Decreased attentional control (being more prone to distractions)

- Greater performance speed

- Increased errors

Consistently, researchers in arousal have difficulty determining exactly at what level arousal is helpful and at what level it becomes harmful. Investigation of this critical point has proved much harder than expected as this 'cut-off' point seems to vary between both tasks (as illustrated in the Case Study above) and individuals.

A recent up-dating of the Yerkes Dodson Law has tried to account for this variation of optimal arousal levels with the introduction of the concept of 'individualized zones of optimal functioning' (IZOFs)[39]. The concept of IZOFs suggests that the actual level of arousal at which optimal performance occurs can differ between individuals. This means that what will be optimal for one person may be too much for someone else.

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[35] *Reference 18*
[36] *e.g. Reference 19*
[37] *for example Reference 20*
[38] *Reference 21*
[39] *e.g. Reference 22*

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C. 2.2.2 *Psychological, cognitive and behavioural changes*

In addition to the physical changes associated with high arousal, anxiety also includes a 'worry', cognitive component, i.e. the uncontrollable thoughts about fear of failure. Many researchers in the field would argue that this element is just as, if not more, important that the physical changes in the experience of anxiety[40]. This means that experiencing an increase in arousal on its own is not enough in itself to make up the experience of anxiety, people also need to experience the worrying and uncontrollable thoughts.

The following effects on attention and information processing have been found with some consistency in anxious individuals[41]:

-	Increased attentional selectivity	Attention being more focused, usually on objects, words etc that are associated with the threat, to the detriment of other information; Difficulty integrating information from more than one source;
-	Interpretative bias	Tendency to interpret information as threatening;
-	Decreased attentional control	Reduced ability to control thoughts and focus of attention: e.g. not being able to stop fixating on a specific object;
-	Decreased short-term memory storage	Reduced ability to hold items in short term (i.e. immediate) memory;
-	Impaired long-term memory	Reduced ability to either store or retrieve information from long-term memory[42]; greater ease in remembering negative events;
-	Increased errors	Increased human errors, i.e. unintentional behaviours;
-	Decreased task efficiency	Increased energy required to complete the task.

Some of these cognitive changes could be explained in terms of a decrease in overall processing capacity: i.e. if someone is experiencing anxiety, they will be experiencing a high quantity of worry-related, task-irrelevant thoughts which may interfere with their attention and capacity to process task-relevant thoughts[43]. If this were the case, this might also explain why anxiety can result in a decrease in overall performance efficiency: i.e. people who experience anxiety can produce the same outputs as those who do not, but at a greater energetic cost. This could reflect the greater degree of effort needed by those who experience anxiety to keep focused, concentrate and deal with task-unrelated thoughts and exclude task-irrelevant thoughts.

The cognitive changes also mean that someone who is anxious is generally more vigilant for threats, such that when a threat is present their response is heightened[44]. The effect is described as 'coiling the spring' or priming the body and could have important implications for performance: being vigilant for a threat could improve reaction to the actual threat when presented but there is also the possibility that those who are vigilant for threats could over-react when the threat is actually present.

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[40] *Results of experiments reported in Reference 23*
[41] *Reference 23*
[42] *Reference 16*
[43] *Reference 23*
[44] *Reference 24*

Some researchers have tested specific elements of the association between anxiety and performance deficits. For example Lavric et al[45] proposed that the type of anxiety experienced when threatened (a combination of high arousal and worry) and short-term memory for spatial information call on the same mental resources, and aimed to test this theory by measuring the performance of participants on verbal and spatial memory tests in the presence and absence of the threat of electric shock. The results showed that when the threat of a shock was present, performance on the spatial memory test was affected. They also found that higher heart rate and subjectively reported anxiety led to greater disruption of spatial memory.

The effects of high anxiety on performance have been of great interest to the military, for obvious reasons. For example, a recent study evaluating the effect of prolonged anxiety during military training has also found that logical reasoning was highly susceptible to degradation during a one-week training exercise. The results of this study also support the previous study, as participants' ability to process spatial information was also seen to deteriorate over time[46].

The tables below report the results of some high-profile investigations; in these cases the behaviour of the people involved can be understood as the consequence of the anxiety they were feeling.

C.2 - Table C: Piper Alpha Case Study

In the Public Enquiry into the Piper Alpha disaster[47], Lord Cullen presents evidence to suggest that the OIM's command and decision-making abilities were severely hampered by his reaction to the situation developing around him. Survivors have described him as being in a state of panic or in a state of shock, both associated with the experience of anxiety. Two specific examples of this outlined below:

After the initial order to transmit a Mayday message, the OIM left the control room without issuing further orders to the radio operator regarding either evacuation of the platform or communications with other platforms or the Occidental office in Aberdeen – both these orders were included in standard operating procedures for this situation. When the OIM return shortly after, he was in what the radio operator described as "a state of panic", apparently after having discovered that access to the radio room was on fire. After deciding to evacuate, the OIM ordered a message be transmitted to indicate that the platform was being abandoned, but did not state by what method; initiate attempts to call in helicopters to assist or attempt to communicate with other platforms, his crew, his senior staff, or the shore – again, all actions that would have been included in standard operating procedures to be followed in an emergency.

In addition, another witness stated that, when asked a specific question about which procedure to follow, the OIM did not answer. This lead the witness to assume that he was in a "state of shock".

Understanding how anxiety affects thinking can help to explain his behaviour on the day, and specifically how his ability to process information and use it to make decisions was so badly affected: for example: the OIM seemed to be fixating on the threat itself, taking attention way from the more complex cognitive task of organising an evacuation. Since Piper Alpha, it has become standard practice to provide OIMs with regular scenario-based emergency training. One aim of this is to ensure in an actual emergency, a situation that is very likely to make people anxious, the OIM's performance is not significantly affected.

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[45] *Reference 25*
[46] *Reference 26*
[47] *Reference 27*

C.2 - Table D: Ocean Odyssey Case Study

Evidence provided by survivors of the Ocean Odyssey incident in September 1988, in which a semi-submersible drilling rig suffered a series of explosions and caught fire, provides a further example of how feeling anxious can affect performance, in this case memory for procedures.

At the time when the crew were boarding lifeboats, conditions on the platform were characterised by high levels of noise from a gas blowout, and realisation that control of the well had been lost and that levels of danger were increasing. Therefore a combination of high levels of arousal and high worry were present.. Accounts of survivors indicate that under these conditions, critical, methodical pre-launch checks of the lifeboats were not carried out, for example, hanging-off pennants were not removed. Luckily these were spotted by one of the survivors and removed in time prior to launch.

C. 2.3 Conclusion

The experience of anxiety is a combination of changes in the individual's thinking and increased arousal. This can affect anybody and is not, in itself, a sign of ill-health or necessarily harmful to the individual.

The physical changes associated with anxiety are an increase in arousal levels significantly altering the functioning of both body and mind. Both high levels and low levels of arousal result in sub-optimal task performance. Levels of arousal will be influenced by both characteristics of the individual and characteristics of the task (for example, task complexity); it is therefore difficult to specify exactly what levels of arousal will lead to optimal performance for specific tasks.

Common negative effects of anxiety (combination of high arousal and cognitive changes) are:

- o Decrease in memory functioning (particularly for spatial information)
- o Decrease in distractibility; increase in selectivity
- o Increase in fatigue with a reduction in level of efficiency in task performance
- o Increase in task un-related thoughts (preoccupation)
- o Unreasonable fearfulness
- o Increase is errors

It is interesting to note that people suffering from clinical anxiety report similar negative effects as those who are highly anxious. However, obviously, these will be experienced much more often (e.g. more days than not) and for a much longer period (e.g. more than 6 months for a diagnosis of Generalised Anxiety Disorder). The symptoms themselves are likely to be more severe and the effects are more debilitating.

Panic attacks can have a severe impact on behaviour, often due to the frightening physical symptoms such as palpitations, hyperventilation and chest pains. Often the fear of future attacks can preoccupy sufferers and can be a factor in preventing timely return to work.

C. 2.4 Implications for safety

When considering safety, the main implications for a non-clinical population will be:

- To ensure that arousal levels are optimal for the task needing to be performed - and

- To ensure that the combined effects of anxiety are reduced or minimised so as not to interfere with task performance;

For simple tasks that don't provide much stimulation, it will be important not to let arousal levels become too low, as this could affect performance. Use of additional stimulating tasks to maintain arousal levels during critical periods can help reduce the likelihood of human failure leading to an incident.

Complex tasks are more likely to result in higher levels of arousal and, potentially, anxiety and worry, which could affect performance. It will therefore be important to decrease the experience of anxiety, either by changing the physical symptoms (i.e. decreasing the level of arousal) or by counteracting the changes in thinking. Some examples are reported in the table below which could be applied to improve performance in all anxiety-inducing tasks or situations:

C.2 - Table E: Example anxiety-reduction techniques

Decreasing levels of arousal	Counteracting changes in thinking
Forcibly check and slow breathing rate	Continuous challenge to ensure all the data has been considered;
Practice exposure to high arousal to increase control over the effects	Explicitly considering the 'best-case' scenario as well as the 'worst-case';
Practice emergency drills to help manage arousal levels in the case of an actual emergency and to make required actions second nature	
	Using memory aides;
	Forcibly stopping or slowing the pace of the decisions and considerations: planning them out, forcing attention back to the main issue;

Some characteristics of work that could increase the impact of anxiety in an emergency are:
- Over-reliance on memory for spatial information (e.g. not providing schematics or other forms of reference);
- High proportion of inexperienced staff (e.g. more likely to worry about own abilities and/or experience, sudden increases in high arousal, i.e. panic).

In clinical sufferers the impact on the ability to concentrate is likely to be exacerbated, and the ability to focus attention is therefore likely to be affected. In clinical anxiety, the major difference from non-clinical cases is the tendency to focus attention on perceived threats to the exclusion of other relevant information. It is therefore possible that workers suffering from clinical anxiety will exaggerate the importance of minor safety issues.

People who suffer from panic attacks can find the symptoms completely debilitating and in most cases will withdraw from work. The implication for safety in such cases tends to be the re-distribution of that person's tasks throughout the rest of the team – this can then become a workload issue.

There have been cases where a panic attack has caused a fatality where the individual has been working in a hazardous environment. In November 2001, for example, a trainee diver died after suffering a panic attack when she was unable to clear her ears. She became so agitated she lost her air supply and became separated from her instructor in murky water (BBC News 22 November 2001).

C. 3 DEPRESSION & PERFORMANCE

C. 3.1 Clinical Population

When diagnosing an individual with depression, clinicians would usually be looking out for the experience of the majority of the following symptoms on a regular basis, e.g. everyday during the same two-week period[48]:

- Fatigue or loss of energy;
- Feelings of worthlessness or excessive guilt;
- Depressed mood most of the day;
- Diminished interest or pleasure;
- Significant weight loss or gain with no particular attempt to do so;
- Insomnia or, to a lesser extent, hypersomnia;
- Psychomotor agitation or retardation;
- Diminished ability to think, concentrate or make decisions;
- Recurrent thoughts of death.

A study of over 500 male and female patients on the frequency of occurrence of specific symptoms revealed that depressed mood and loss of interest and working capacity were experienced by nearly all patients (98.8 to 100%). The study also showed that both psychological and physical symptoms of anxiety were reported with very high frequency by both men and women suffering from depression (between 97.7 and 87.3%) – this would indicate that the overwhelming majority of people who are diagnosed with depression are also suffering, to some extent, from increased anxiety[49].

There has been detailed analysis of the effects of depression on performance. The majority of the research agrees that people suffering from depression will experience some negative effects on their cognitive performance; the effects most commonly replicated are the following:

- Decrease in ability to have sustained attention, frequent attention shifts;

- Greater number of errors (both of omission and commission);

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[48] Reference 2
[49] Hamilton (1989) reported in Reference 28

- Decreased ability to recall information: impact on explicit memory stronger than on implicit (procedural) memory;

- Tendency for biased recall of information: greater recall of negative (mood-congruent) information – i.e. tendency to rate own performance more harshly;

- Significant decrease in motivation and sense of reward from achieving positive performance – i.e. less motivation to perform a tasks well;

- Some decrease in psychomotor activity.

It is a recognised key feature of depression to become more withdrawn from others. Suffers of depression often shy away from social contact and avoid these situations more than they may have done in the past. Common implications of this difficulty with social interaction are: difficulty communicating with others, avoiding non-essential communication and interaction, difficulty remaining calm under pressure, difficulty getting on with others.

There has also been significant research on the relationship between depression and memory. This has produced mostly consistent results indicating that people who suffer from depression will suffer significant problems with memory, especially recall of information[50]. Some researchers have argued that this effect on memory may be partly linked to anti-depressants and may be stronger in certain types of depression more than others,[51] though there is evidence of short-term memory problems in patients who are depressed and not taking medication. It is interesting to note that this effect on memory has been linked to an increase in levels of certain hormones (glucocorticoids), present both in people who are experiencing prolonged stress and in people suffering from depression[52].

In summary, there is significant evidence that people suffering from depression will experience significant negative effects on their cognitive performance as well as their social performance. Both of these combined will significantly alter an individual's overall performance.

C. 3.2 Non-Clinical Population

There are several theoretical and methodological problems associated with the study of the effects of depressive symptoms on work performance in the general population. Firstly, many people who suffer from more severe depression are not actually at work; secondly, people who are at work may not be able to give an accurate rating of their own performance as the symptoms of depression itself can cause a negative distortion of people's perception of themselves (i.e. they will rate it worse than if they were not suffering from depression).

A recent study reported in the American Journal of Psychiatry tried to counteract both the difficulties.[53] It studied the effects of depression on moment-in-time work performance of airline reservation agents and telephone customer service representatives. The researchers looked at two dimensions of work performance: productivity and task focus. They found that major depression commonly related to significant decreases in both task focus and productivity – these decreases

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[50] e.g. Reference 29; Reference 30
[51] Reference 31
[52]Reference 16
[53] Reference 32

were such that the authors calculated that they were equivalent to 2.3 days absence per depressed worker per month.

Another study that addresses these issues is that by Martin and colleagues[54]. They also sampled performance of people at work but, in order to combat possible negative biases, asked the participants' performance to be rated by another person, usually a colleague or a superior. The sample covered a range of occupational groups representative of an inner-city population in the USA, the authors do not specify what these occupational groups were. They also found a significant impact of depressive symptoms on both 'technical performance' on the job (handling demands; making right decisions etc.) as well as on 'social performance' (getting along with others; being calm etc). Importantly, they also found that the effect of depressive symptoms on technical performance cannot be solely explained by the effect on social performance. This means that people suffering from depressive symptoms will perform worse at work and that this is not solely caused by difficulties they may be experiencing engaging with colleagues socially.

In summary, research suggests that the performance of people who are at work and suffering from depression or symptoms of depression is negatively affected in two ways. Firstly, they will experience more difficulty interacting with people – this is likely to have an indirect effect on their performance: i.e. disrupting mechanisms that make effective performance more likely. Secondly, their actual ability to complete job-related tasks will be negatively affected: they will be less focused and less productive.

C. 3.3 Negative Mood

The findings above related to people who are suffering from depressive symptoms who are at work. However, to better understand this impact of negative emotions on behaviour, it is also interesting to briefly investigate the impact of negative mood on performance.

The investigation of the effect of negative mood on performance has been carried out in a variety of ways: for example, either by experimental mood induction or by analysing the experience of people who report low mood. Both types of study report evidence that people in a low mood will experience similar effects on their performance as those suffering from depression.

Firstly, there is evidence that experiencing low mood will also impact on people's interest in social behaviour. People with low mood will be less likely to express an interest in pro-social behaviour but will prefer sitting and being alone[55].

Secondly, there is also some evidence that a low mood will affect people's memory, again, in a similar way as a clinically diagnosed population. Initial studies in this field[56] showed that people who were asked to remember information when in a sad mood would be more likely to remember information that was also sad. There has been some discussion about whether this effect can be explained by low mood causing better storage of sad information at the time of memorising or, on the other hand, whether a low mood makes it easier to retrieve sad information. It is however becoming clear that this memory bias is key to the experience of low mood and the ability to manipulate thoughts and recall positive information is an effective way to lift the mood.

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[54] *Reference 33*
[55] *Reference 34*
[56] *Reference 35*

Thirdly, there is some evidence from laboratory-based experiments to suggest that depressed mood has a significant effect on the ability to sustain attention over a period of time. The same experiment found that when depressed subjects were asked to rate their performance, they exhibited a heightened sense of subjective failure than non-depressed subjects.[57]

These negative effects of low mood on cognitive performance are usually explained in terms of lack of energy, motivation and attention. This is a similar explanation to the ones offered for patients suffering from depression.

However, there is also research that reports that there may be benefits of a low mood. There is some evidence to suggest that people in a negative mood pay more attention to detailed information and engage in more creative problem-solving[58]. There is also some agreement that people in a negative mood engage in information-processing strategies that require less effort such as analytical processing or categorising. This would be compatible with the experience of a negative effect of negative mood on more complex information-processing and decision-making.

In summary, people who are depressed or people in a low mood also show some of the negative effects on social and cognitive performance evidenced in people suffering from depression. In particular, the effect on social behaviour and memory is seen as strong. There is, however, also a suggestion that a negative mood may, in some circumstances, produce changes in thinking patterns that may be useful to the situation. As with anxiety, the key will be to be able to lift out of this mood successfully when appropriate.

C. 3.4 Conclusion

The debilitating effect of depression on a person's performance has been attributed to the combination of the negative impact on their information-processing abilities and the deterioration of their social skills.

In particular, the following effects have been found in people who suffer from depression, people suffering from the symptoms of depression, and those in a low mood:

- Lack of interest and energy

- Negative thinking bias

- Impaired memory

- Withdrawal from social interaction

- Increase in human errors

- Difficulty focussing and maintaining attention

- Impaired judgement and decision making

- Insomnia

- Chronic tiredness

- Irritability

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[57] *Reference 36*
[58] *Reference 37*

C. 3.5 Implications for safety

When considering safety, the above conclusions have a series of repercussions.

Since one of the most common symptoms of both clinical depression and low mood is withdrawal from social contact, this means that it may be harder for both team members and team leaders to detect depression in a colleague.

Tasks that may be particularly affected by depression are:

- Simple tasks where reaction time is the most important element, due to a delay in the response to information;

- Monotonous tasks with a high potential for distraction due to falling interest in the task;

- Tasks that require focussed or sustained attention (e.g. monitoring for a rare event);

- Tasks that require a high level of social interaction and/or a high level of discretionary effort.

The negative bias in thinking may actually prove to be useful in certain tasks, such as risk assessments. It could be that the depressed person will be more able to visualise some of the risks as real and therefore make a significant contribution to this. The main challenge will be how to move on from this perspective to one that is more constructive.

In order to minimise the possible negative effects, the following could be helpful for both individuals or teams:
- Regular motivation and confidence building exercises: from actual group exercises to regular up-dates on successes and progress
- Explicitly considering the 'best-case' scenario as well as the 'worst-case';
- Using memory aides;
- Setting out clearly the minimum level of social interaction needed for the task's completion;
- Building in regular team events to maximise informal interaction and support among team members.

A key challenge for managing people who may be experiencing depression is to find ways in which to reward performance and keep motivation high. Simple performance feedback techniques that ensure praise is accurate, timely and person-specific will help as will explicitly asking the individual what they would find rewarding. Setting short-term objectives and breaking down longer-term goals into smaller chunks will also help.

In cases of clinical depression, the main impacts on performance could come from the experience of chronic tiredness and severe impairment of judgement and decision-making.

Workers suffering from clinical depression would therefore be more likely to be severely impaired whilst driving or operating machinery.

Tasks or roles with a high decision-making content are also likely to be negatively affected in clinical depression, so critical or important decisions should be made by another member of the team or should be deferred until the individual has completely recovered from their depression.

C. 4 MEDICATION USE & PERFORMANCE

The increase in the amount of people suffering from psychological ill health has inevitably led to an increase in the use of prescribed medication. Recent studies have reported increases over a period of 5 years in prescriptions of anti-depressants at 40% for 'older' drugs but 460% for the 'newer generation' drugs[59] – e.g. Selective Serotonin Re-uptake Inhibitors (SSRIs) – that are considered to have fewer side-effects.

C. 4.1 Effects on performance at work

The British National Formulary 48 (BNF)[60] reports side-effects for prescribed medication in use n the UK. The side effects listed are numerous, with the main ones listed below; however these side effects are listed for completeness and there is little information on the frequency, severity or likelihood of experiencing them.

The side effects reported in the BNF for SSRIs, commonly prescribed for depression, that may affect performance at work include: nervousness, anxiety, insomnia, dizziness, hallucinations, mania and visual disturbances; there is also an extensive list of possible interaction effects of SSRIs with other agents, one of these being alcohol. In addition, the Medicines and Healthcare products Regulatory Agency (MHRA) has undertaken comprehensive research in recent years to establish whether SSRIs are associated with increased suicide risk and whether significant withdrawal effects are experienced[61]. The report concluded that:

- "a modest increase in the risk of suicidal thoughts and self-harm for SSRIs compared with placebo cannot be ruled out"
- "all SSRIs may be associated with withdrawal reactions on stopping or reducing treatment. (…). A proportion of SSRI withdrawal reactions are severe and disabling to the individual." And "The most commonly experienced withdrawal reactions are dizziness, numbness and tingling, gastrointestinal disturbances (particularly nausea and vomiting), headache, sweating, anxiety and sleep disturbances."

The side effects reported for benzodiazepines, commonly prescribed for anxiety, that may affect performance at work include: increase in excitement and/ or aggression, increased anxiety and perceptual disorders. Common side-effects associated with a number of specific medications include: impaired judgement, increased reaction time (i.e. slower responses), confusion, dizziness and hallucinations, disturbances of hearing and memory disturbances.

In recent years, there has also been some research with people taking medication for neuroses specifically to understand the effects reported by people on performance at work. In the first study, participants who had experienced anxiety and depression were recruited to focus groups to ask them to talk about their symptoms, the medication and of the effect on their work. The study focussed on the healthcare, education, manufacturing and transport industries, and tried, but

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[59] *Reference 38*
[60] *Reference 39*
[61] *Reference 40*

failed, to obtain the participation of the construction industry. Participants reported difficulty distinguishing between the adverse effects of the psychological ill-health and the adverse effects of the medication they were taking for this. Commonly reported symptoms included: confusion, dizziness, nausea, lack of motivation and a general lack of engagement with activities, which often led to a lack of interest in work. In some cases, the medication actually made symptoms of ill-health worse initially.

A consequence of these side-effects was that participants were more likely to discontinue treatment or to alter the dose they took themselves – both factors that have been associated with significant side-effects in themselves[62]. Some participants also reported concerns about becoming addicted to the medication and would discontinue as soon as they felt an improvement in their symptoms. The lack of information available to patients about possible side-effects, their likely duration and the likely time-lapse before an improvement to psychological health was seen as a significant factor in patient compliance. If the participants had been more informed from the start, the study suggest, compliance would have been higher.

On the whole, participants felt there was a stigma associated with mental health in the workplace. This feeling was strong even though most felt that the increasing workload and unsupportive managers had contributed to the development of their illness. This meant people suffering were likely to try and cover their symptoms and not report any problems to either existing managers or future managers when applying for new employment.

The study also consulted panels of experts and the general agreement was that there was more risk in suffering from depression or anxiety and not being treated, than in suffering some side-effects of effective medication. This group also reported that there are greater risks associated with self-medication: e.g. using other substances to help cope with the symptoms. Alcohol in particular was mentioned as commonly used for self-medication.

This study presented evidence from a relatively small number of participants. It is also limited by the fact that all the evidence is also based on what participants themselves reported. However, it does seem to confirm what little research has been done in this area suggesting that the increase in prescribed medication is negatively impacting on the working population.

C. 4.1.1 Examples of self-reported effects of ill-health/ prescribed medication

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Example 1 – human error:
An experienced teacher noticed their performance deteriorating. They began to make what they termed 'classic errors' which they did not expect to be making after 20 years of experience. The frequency with which these errors were occurring was increasing, up to the point where the individual's line manager raised his performance as an issue.

If this person had been operating in a safety-related role, suddenly beginning to make elementary errors could have a profound effect on the safety of the operation. Furthermore, if this were a long-serving, highly experienced operative, then they may well be working with minimal supervision, and hence the opportunities to trap the error prior to an incident would be reduced.

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[62] Reference 40

Example 2 - concentration:
A psychiatrist found that her ability to concentrate was being affected, but because she felt that she would be letting people down by taking time off, she pushed on and became more seriously affected.

This case could have had serious safety implications if the psychiatrist's prescribing had been affected. A prescribing error could, in the worst-case scenario, result in a patient being issued with a harmful dose of medication, or an inappropriate medication for their condition.

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Example 3 – decision-making:
A medical consultant found herself becoming very indecisive at a time when she was having to make decisions. This resulted in her feeling that she was being pushed into making hasty decisions, and she worried that some of these decisions may have been wrong.

In a safety-critical role in the process industries, an individual could be required to make critical decisions for example during an emergency. If similar symptoms were present, the implications could be extremely serious.

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Example 4 – judgement:
A school teacher at school after hours decided to climb out through a window to retrieve a football that was lying in the playground rather than walk all around the school to get out and back in again. When he landed he slipped and sustained a leg injury which persisted for several weeks and required surgery.

The teacher's judgement was impaired by his medication, and he decided that taking this shortcut was acceptable in terms of risk exposure. This clearly has significant consequences for industry in general, and indicates that some forms of medication could affect the incidence of violations and judgement errors.

The second study has addressed some of these limitations and conducted a more detailed analysis of types of medication used and impact on performance and accident rates specifically.

Overall, they reported that 9% of the working population was currently using psychotropic medication; the most common medication was SSRIs. Use of SSRIs had a detrimental effect on cognitive performance through:
- reduction in reaction time;
- memory impairment.

Diaries of people using SSRIs also reported a higher rate of lost concentration and increased frequency of human errors.

However, the study reported that there was no association between taking medication and minor injuries at work. However, there was an association with increased work-related road traffic

accidents and an association between use of the older type of anti-depressant and accidents, though this was not one of the most important predictors. There was also a reported association between use of SSRIs and accidents outside work.

In general, the findings of the second study are to be considered more robust as they do attempt to distinguish between the effects of the medication and the effects of the actual mental health difficulties the individuals are experiencing.

C. 4.2 Conclusions

In summary, there are numerous reported side-effects of medication commonly prescribed for depression, anxiety and stress. However, there is less accurate information about how frequently they have been observed and therefore how likely they are to happen. The reported association between SSRIs and increased risk of suicidal thoughts has been a cause of concern and a focus of research in particular, though there is as yet little firm evidence of direct causation. Significant withdrawal effects for SSRIs are also reported.

Studies that focus specifically on investigating the effects of prescribed medication for people who experience depression and anxiety report that individuals themselves perceive this impact to be very significant, though they may also have difficulty distinguishing between the effects of the ill-health and of the medication. In particular, they felt that the dizziness, the lack of concentration and the greater tension led to a series of minor errors, often resulting in injury. There were also several cases where people felt that their judgement and decision-making was impaired due to the medication. Most participants reported not concentrating as much as the main cause, though some also reported acting more impulsively and taking more risks. Some also reported that the lack of interest they were experiencing meant they paid less attention to aspects of their work than they should have.

More controlled studies report a significant negative effect on performance but a weaker influence on safety, in the form of accidents and incidents at work. The relationship is stronger, however, for road traffic accidents and accidents outside work.

There is also evidence to suggest that what are perceived to be side-effects from the medication may lead patients to discontinue their treatment, leave their symptoms untreated or sometimes attempt to self-medicate.

In all cases, the organisation is unlikely to know anything is wrong, however, until something serious happens (e.g. an accident or prolonged illness), as the stigma associated with mental health at work encourages under-reporting. It can also be linked to a misperception by the employee that the medication will not have any negative side-effects and that those taking it are under no obligation to report this to their employer.

C. 4.3 Implications for safety

The increased prescribing of medication for anxiety, depression and stress may be having an effect on performance at work, though this is difficult to quantify exactly, partly due to lack of data on frequency of side-effects, partly due to the fact that the side-effects will be quite similar to those associated with the psychological ill-health for which it is taken.

For most organisations, acting on these and similar results implies striking a balance between their duty to reduce risk as low as reasonably practicable and the rights of the individual, e.g. their right not to be discriminated against unfairly. In some safety-critical industries, such as aviation or air traffic control, the probability of medication negatively affecting performance, though relatively low, is high enough to justify regular medical screening and compulsory reporting of medication use. Others will need to investigate this in relation to their specific safety-critical tasks and to specific types of medication before taking action.

C. 5 FATIGUE & PERFORMANCE

Fatigue is a symptom common to various forms of psychological ill-health, especially depression. Feelings of fatigue can also be due to disturbed sleep patterns, again common in people experiencing psychological ill-health related symptoms (for example, worry). This section does not attempt to be a comprehensive literature review of the effects of fatigue on performance but a summary of the most consistent findings that apply only to the consideration of psychological ill-health and frame of mind, and their impact on safety.

C. 5.1   Effects on performance

The effects of fatigue have been studied in a variety of laboratory and applied settings: some evidence is from experiments, other theories are the result of accident investigations were fatigue was seen as a major contributing factor.

The main effects of fatigue on safety are commonly recognised as:

Effects on attention
- Decreased ability to concentrate on multiple tasks;
- Fixation (difficulty attending to more than one task);
- Distractibility;
- Reduced visual perception;
- Increased reaction time.

Effects on memory
- Short-term memory loss.

Effects on decision-making
- Impaired judgment;
- Impaired decision-making ability.

Effects on motivation / personality
- Indifference to one's performance;
- Loss of initiative;
- Personality changes;
- Depression.

To understand just how severe these effects can be, it is interesting to note that one study showed that sustained wakefulness of 24 hours results in a decline in psychomotor performance

equivalent to a blood-alcohol concentration of 0.10%[63]. - in the UK it is illegal to drive with a level above 0.08%

There is evidence to suggest that these effects will affect performance in simple tasks more than complex ones. For example, in a study by Friedman et al (1971) surgeons who had been awake all night made 20% more human error and took 14% longer to complete tasks requiring vigilance than those who were fully rested.

There is also evidence that the negative effects of fatigue on performance can be negated during crises, novel situations or exciting, active and stimulating tasks. However, the same research suggests that this is not the case for routine or repetitive tasks, or tasks that require sustained vigilance, such as checking tasks [64][65].

Research conducted by the Australian Medical Association and the British Medical Association suggests that impaired memory due to fatigue may be a key mechanism in reducing the effectiveness of learning. In particular, there is evidence to suggest that the ability to retain new information when sleep deprived was impaired. However, information learned when fully rested could be adequately recalled when sleep deprived. This suggests that the effect on memory of sleep deprivation is primarily on the retention of information, rather than the recall of information[66].

It is interesting to note that many of the effects described above are similar to those reported by people suffering from depression and similar to the effects of low arousal. In both cases, there is a general slowing down of reflexes and reaction times, and an increase in negative thinking.

C. 5.1.1 Case Studies of effects of fatigue on safety

Case study 1 – Decision-making and sensory perception
A pilot who had been on duty for 18 hours and had been flying for 9 hours was attempting to land at Guantanamo Bay in Cuba. A strobe light on the ground was intended to provide a visual reference to the pilot but was inoperative at the time. The pilot did not know this and focussed his attention on searching for the light.

His attention during this period of time was taken away from the speed and altitude of the aircraft, so unknown to the pilot the aircraft was getting too low and slowing down so much that it was likely to stall. The pilot was warned repeatedly by other members of crew of the slow speed of the aircraft, but no action was taken. The pilot turned the aircraft onto final approach, at which point the aircraft stalled and crashed ¼ mile from the end of the runway.

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[63] Reference 41
[64] Reference 42
[65] Reference 43
[66] Reference 44

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Case study 2 – Decision-making
At Salt Lake City in 1989 the pilot of a Boeing 707 aircraft emerged from cloud at 200 feet to see the runway 150 feet to his left. Instead of going around again, he decided it would be possible for him to land and he made a tight turn to align himself with the runway. His left engine was dragged along the runway, digging a gouge 60 feet long in the tarmac.

Over the preceding 30 hours, the pilot had been on duty for 19, flying for 13 and had been off duty for nearly 12 hours. During his time off duty, the pilot had only slept for one hour.

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Case study 3 – Falling asleep
In February 2001 at Great Heck near Selby, Yorkshire, the driver of a landrover fell asleep at the wheel whilst driving on the M62 motorway. His vehicle left the road and rolled down the embankment onto the East Coast Main Line railway track. Shortly afterwards, the landrover was hit by a passenger train, partially derailing the train and forcing it into the path of an oncoming freight train

C. 5.2 Conclusions

There is ample evidence, from both experimental studies and studies of performance at work, to show that performance can be significantly impacted by fatigue. The effects can be very severe, and seem to mostly affect peoples' attention, reactions and motivation, leading to potentially significant knock-one effects on a variety of activities such as decision-making, visual search, manual tasks, etc.

C. 5.3 Implications for safety

Fatigue is likely to have an effect on most tasks, especially:

- Tasks that require timely reaction, especially those that are routine and do not occur in circumstances that may raise the level of arousal (e.g. responding to a non-critical warning as opposed to responding to an emergency alarm).

- Performance that requires the individual to divide their attention between multiple tasks; the individual may be more easily distracted from their task or may find it harder to process multiple pieces of information and may fixate on one aspect of the task to the detriment of others.

- Tasks that need to be performed in low-arousal conditions, for example between the hours of 03:00 and 06:00 when the circadian rhythms mean that levels of arousal are at their lowest.

In order to mitigate some of the potential effects of fatigue, the organisation can make sure that in situations such as those listed above, the individual receives some form of stimulation. For example, arranging work so that there are more stimulating activities during a night shift, and less lone working.

The key challenge to organisations will also be to increase awareness of the effects of fatigue in individuals. This will in turn make it more likely that individuals will take action when they feel fatigued. Some of the interventions that should be borne in mind are therefore workforce education programmes, in addition to identification of work-related stress symptoms at an early stage.

C. 6 SECTION SUMMARY

The following is a summary of the main findings reported in this Section.

-   There is some evidence for the impact of stress on performance and safety, and in particular for the impact of burnout. This is possibly linked to diminished attention associated with a combination of distractions and diminished ability to control thoughts and behaviours. The conclusions that can be drawn from many studies in this field are limited by the lack of clear definitions of 'stress' and 'feeling stressed'.

-   There is ample evidence that optimal levels of arousal increase performance and high or low arousal will diminish it. A definition of 'optimal' level of arousal is difficult as this will be linked to task characteristics and individual differences.

-   The effects of high arousal, anxiety and clinical anxiety are similar and negatively affect attention, memory and efficiency in task performance. People suffering from clinical anxiety are likely to report more debilitating effects and greater cognitive interference from anxious thoughts.

-   The debilitating effect of clinical depression on a person's performance is likely to be associated with significant deterioration in both their information-processing abilities and their tendency to withdraw from social interaction. Similar effects are found in both people experiencing depressive symptoms and those experiencing low mood.

-   There is some evidence that the effects of prescribed medication for depression and anxiety also impact on performance, though it is difficult to estimate how significant an additional negative impact this has.

-   There is ample evidence that performance is significantly impacted by fatigue. There is also some similarity between the effects of fatigue and those of depression.

SECTION D - Psychological Ill Health: Evidence

This section investigates accidents and incidents that have already happened to understand how they could have been caused or contributed to by psychological ill-health and related symptoms.

D. 1 INTRODUCTION

Human behaviour is at the root of many accidents and incidents, especially in more advanced technical systems where complex equipment and systems are in place. Often, accidents and incidents where the root cause is 'human failure' are the most complicated to understand and write recommendations for. Human beings are non-deterministic in nature. This means that it is not possible to predict how a person will behave in any given set of circumstances. Therefore, unlike hardware and software, addressing the root cause is often seen as harder than addressing root causes associated with engineered systems. The question that often remains unanswered is: why did the person behave the way they did?

This section will investigate actual accidents and incidents where psychological ill-health has played a causal or contributory role to help understand this question.

Information will be drawn from three different sources:

-   Industry partner accident database (2002 to near end 2005)

-   Database of transport sector accidents

-   Interviews with investigators or individuals involved in accidents where psychological ill-health and related symptoms were causal or contributory factors

When analysing human failures, the analysis will distinguish between[67]:

Human errors   A behaviour which was *not intended*, which involved a deviation from an accepted standard and which lead to an undesirable outcome

Violations   A *deliberate* deviation from a rule or procedure

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[67] *Reference 46*

## D. 2 EVIDENCE FROM INDUSTRY PARTNER DATABASE

The first step in understanding how psychological ill-health could have caused or contributed to accidents/ incidents at work was an investigation of an industry accident database.

The project's Industry partner uses an electronic database to record actions associated with accidents and incidents. The database's main aim is to ensure that actions are correctly followed through, however, all entries also include a description of the incident itself and the majority also include information about the likely causes of the incident, based on a comprehensive categorisation system. This root cause analysis system is well-established and extensively used in several industries in the UK. The database therefore, whilst not necessarily an absolutely complete record of all accidents, incidents and their causes, offers a valuable resource for real-life examples of the impact of psychological ill-health related symptoms on safety.

D. 2.1 Initial Analysis

The industry partner allowed access to their records dating from 2002 to 2005. Records were identified for analysis where the causes identified at the time of the investigations related to psychological ill-health or the individual's frame of mind. These system causes were classified in the database as 'mental health' or 'mental stress' and their relevant sub-clauses (see Appendix Section 1.1 for more detail). It is important to note that the classification is not exclusive – i.e. that an accident could be classified as being caused/ contributed to by both mental stress and mental state.

A total of 229 records were examined where 'mental state' or 'mental stress' was referred to as a system cause. The incidents the records referred to ranged in severity from first aid injuries to fatalities, and the following chart shows the records identified, classified according to the severity of incident.
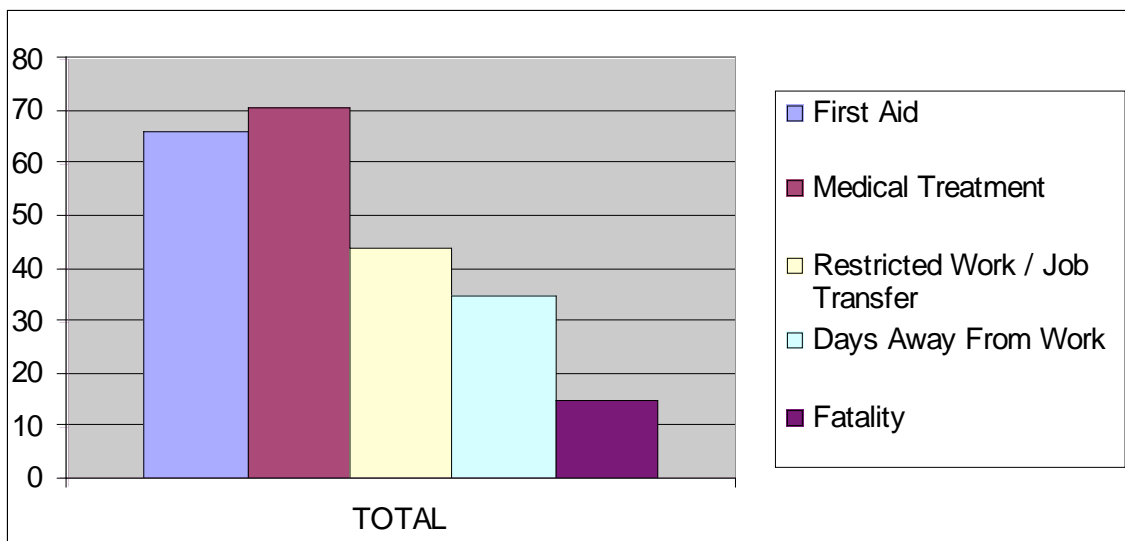
D.2 – Chart A: Mental state/ stress incidents by severity

The following chart shows the number of records identified by the severity of the incident broken down by year, though it should be noted that the data for 2005 was not complete as it was extracted in November 2005.
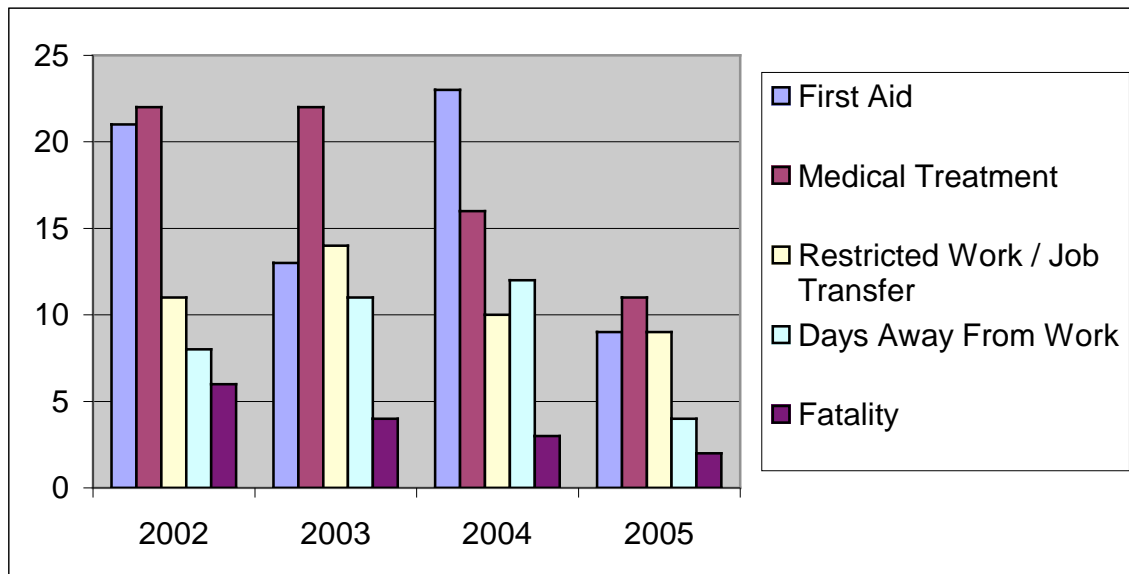
D.2 – Chart B: Mental stress/ state incidents by severity, by year

It is apparent from the preceding graphs that, in the records identified, incidents to do with mental state and psychological ill-health are associated predominantly with first aid injuries and medical treatment injuries. However, it is important to note that, on average, 3 or 4 fatalities every year are associated with mental state and psychological ill-health - this adds weight to the assertion that this is an important association to investigate.

The accident triangle, proposed by Heinrich in the 1930s, suggests a ratio of 29 minor accidents to every fatality. In the data above the ratio is in the region of 4:1 which could be explained in a number of ways: either the accident triangle ratio is not appropriate for incidents involving psychological ill-health or incidents associated with psychological ill-health and mental state are not all being reported or, after having been reported, are not all being recorded in the database. A conclusion on this cannot be reached using this data alone.

Once the incident report was retrieved from the database, further information about the contribution of psychological ill-health was sought, as described in the next section. There were certain factors that limited the possible analysis at this stage:

• **Lack of information**
Half of the records (50.2%; 115 reports) extracted from the database did not include enough information to understand why 'mental state' or 'mental stress' had been considered a contributing factor by the incident investigators. The record was often limited to a short description of the incident and a note of the key causes and actions; this information was often not enough to understand why the investigators thought that 'mental stress' or 'mental state' had been a causal or contributory factor.

- **Psychological state caused by incident**

There were a number of incidents when the record suggested that the classification of 'mental state' or 'mental stress' actually referred to the change in the person as a result of the incident.

In 19 incidents (8.3%) the incidents were caused by something the individual had no control over, (e.g. the actions of a 3rd party) which caused a change in the way the individual was thinking and feeling. In all these incidents, the individual had to cope with a sudden change in the situation around him/her, often resulting in high mental demands: for example, part of the floor gave way as the employee was walking on it, causing some agitation and injury in the individual.

In these cases, the classification of 'mental state' or 'mental stress' seemed to refer to the fact the individual was in a situation that caused some concern and agitation; however, there is no evidence that this caused the incident itself: for example, 'mental state' was recorded as a causal factor in an incident of a man being attacked by a dog but there is no evidence that the man's mental state had caused the attack, rather it appears that the man's mental state suffered as a result of the attack.

In some of these cases, the classification of 'mental stress' or 'mental state' may have been chosen to describe the 3rd party at the time of the incident (for example questioning the mental state of an individual who holds up a petrol station at gunpoint rather than the mental state of the person subjected to the ordeal). However, in only one incident there is evidence that the 3rd party's mental state could have contributed to the incident.

- **Other exclusions**

The following records were also excluded:
  - 4 reports that seemed to related to ergonomics rather than psychological ill-health;
  - 4 reports where fatigue was the main reason for the classification of 'mental stress' or 'mental state', but where fatigue was unrelated to psychological ill-health or frame of mind;
  - 19 incidents where the report was not in English;
  - 2 records where the report was not available.

This resulted in having to disregard 163 (71%) of the incidents extracted from the database.

D. 2.2 Analysis of Causal/ Contributory Mechanisms

The remaining 66 incidents were analysed in more detail to understand how the individual's psychological ill health or frame of mind had been causal or had contributed to the incident occurring.

The aim of this second-stage analysis was to find evidence to answer the following 2 questions:

1. How had the individual's psychological ill health or frame of mind at the time of the incident caused or contributed to the incident?

2. Was the psychological ill health or frame of mind causal or contributory to the incident?

The method applied was expert judgement by two Chartered Occupational Psychologists, specialising in health and safety, with over 20 years combined experience, who reviewed the

incidents and classified them either as causal or contributory to the incident (based upon whether the absence of the state of mind would have prevented the incident or not).

The following table shows the most common causal or contributory mechanisms. These mechanisms are different from the system causes recorded in the accident investigation as they specify how the psychological ill-health related symptoms caused or contributed to the incident.

For example, a classification of 'emotional overload' could have been given both to incidents where the person acted aggressively and to incidents when they acted in an anxious manner.

D.2 – Table A: Causal/contributory mechanisms of incidents

Causal/ Contributory Mechanism		*N*	*%**
Being distracted	By own preoccupations, internal thoughts	16	24
	By others/ external events	8	12
Acting in haste	Due to other demands, implied haste etc.	12	18
	Due to having to respond to unexpected events	9	13.5
Acting in anger	Anger or aggression	8	12
Acting without due care	Using additional force, e.g. due to frustration	8	12
Psychological ill-health causing absence from work		4	6
Suicide (not confirmed)		1	1.5

% of 66 incidents

D. 2.2.1 Absence

The number of cases where psychological ill-health caused absence from work was low (only 6% of all cases).

In 3 of the 4 cases the absence was due to stress experienced at work leading either to complete absence from work or a reduction in working hours.

The fourth case was one of diagnosed depression which was thought to have been brought about by stress at work over a prolonged period of time.

D. 2.2.2 Being Distracted

The most common cause of the incidents in this database was individual being distracted. This accounted for just over a third of the incidents analysed at this second stage of analysis.

In the majority of these cases reviewed the individual was distracted by their own preoccupations or concerns, rather than being distracted by external events, or other people: their mind was not on the job (24% of total cases).

In a quarter of these cases, the distraction actually caused the event – i.e. it would not have happened otherwise – but in nearly 60%, the distraction was only a contributing factor.

When the individual was distracted by their own thoughts, two common causes for distraction accounted for the majority of incidents:

- Concerns about future job insecurity – e.g. plant closure, redundancies

- Concerns about own or family members' health

D.2 – Table B: Distraction – Case Study 1

A person was using a large knife to cut vegetables when the knife slipped and cut his finger (first aid injury). The person was not wearing the correct PPE (gloves) – but this was described as an 'out of character lapse'.

The person commented that he was not focused on the job as much as usual due to concerns about job insecurity. The person had concerns about the rumours of down manning and how this might affect his team and his own job.

There were also cases (12% of the total) where the individual had been distracted by others around him/ her or by external events. In a third of these cases, the distraction actually caused the incident; in the rest it was a contributory factor. The most common source of the distraction was colleagues.

D.2 – Table C: Distraction – Case Study 2

A car carrying two sales employees collided with a tree on the opposite side of the road, apparently when overtaking another vehicle. The driver recollected that the road ahead of him was clear but was unable to recollect the exact circumstances of the collision.

The Industry Partner investigation identified two critical factors:

1. Speeding by the driver
2. Poor concentration, distraction by talking to other driver

Both occupants of the car were initially sent to hospital but recovered fully in a short space of time. The injury was recorded as a Days Away from Work Case.

The type of injury in incidents involving distraction was:

32% First aid treatment
28% Medical Treatment.
20% Restricted Work / Job Transfer
20% Days Away From Work

D. 2.2.3 Acting in haste

In just under a third of records analysed, the incidents was linked to the individual acting in haste (30% of the total records analysed). In a third of these cases, this had caused the incident itself. The reports suggested that the main reasons for the individual acting in haste were either:

-   Having to respond to an unexpected situation or an emergency (likely high arousal);

-   Responding to an implied need for haste.

Acting in haste in response to an unexpected situation or an emergency was a causal factor in the incidents more often than it was a contributory factor. An assessment of exactly how the incident had happened revealed the following factors:

-   The individual was focussing solely on how to escape from a situation they perceived as dangerous and therefore had not shown adequate consideration for performance of the specific task, however simple, leading to errors: for example, tripping up when rushing down a step.

-   The individual was presented with a complex situation, had attempted to give the situation adequate attention, but the combination of the increased demands and the need for speed had lead them to commit errors: for example: making an error when carrying out a complex evacuation.

When the individual acted in haste due to a perceived need for speed, this was more likely to be a contributory factor to the incident, and was only a causal factor in a small number of cases. In these cases, it was not always clear why this perception had arisen, but some common reasons included:

-   Not having sufficient time to complete the task properly, either due to other commitments or the actions of others;
-   Haste was implied by other personnel;
-   Individual was attempting to gain approval for completing the job quickly.

D.2 – Table D: Haste – Case Study 1

An engineer stopped to look at a pump with a suspected bearing failure whilst on his way to a meeting. Whilst he was working on this, the impeller rotated, pinching his finger between the impeller and a nearby impact wrench. The engineer was in a hurry when he stopped to look at the pump; even though he knew it would mean having to rush the job, he stopped in any case

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The type of injury in these incidents was:
29% First aid treatment
24% Medical Treatment.
24% Restricted Work / Job Transfer
14% Days Away From Work
10% Fatality

The two fatalities are worthy of further note here. One involved the asphyxiation of a technician through exposure to nitrogen, the other was a road traffic accident resulting in the death of a pedestrian.

D.2 – Table E: Haste – Case Study 2

The response to a power failure left a plant Shift Superintendent, who was also acting as Area Supervisor, with a number of urgent, concurrent tasks to carry out. One of these was the need to switch the instrument air supply over to nitrogen quickly following a power failure. A key step in the switch procedure, to confirm that all preparations for the switch had been made, was not done – it appears that the supervisor forgot to do this. As a result, a technician was exposed to nitrogen and died.

D.2 – Table F: Haste – Case Study 3

A driver struck a pedestrian whilst driving a truck down a narrow road. The report suggests that insufficient time was left to complete task and that the driver was rushing or feeling rushed.

D. 2.2.4 Acting in Anger

There were several examples recorded in the database of when an individual had reacted in anger, causing injury to another. In just over 70% of these cases, the anger was causal to the event; the individual felt angry and had intentionally acted aggressively and/ or violated rules and procedures.

The majority of these incidents involved two members of staff and the incident itself seemed to be the result of an escalation of a difficult relationship, sometimes following a direct exchange of insults.

D.2 – Table G: Anger – Case Study 1

A team leader asked one of his staff to perform a routine task on one of the machines he was working on. The report indicates that there was a disagreement about when this task ought to be performed and there are witnesses that both men called each other 'stupid'.

Both men were sent to an separate office to await the arrival of the supervisor. When the supervisor arrived, he saw the team leader punch the other member of staff in the face.

The worker received medical treatment to his face; the team leader was dismissed.

The type of injury in these incidents was:
22% First aid treatment
56% Medical Treatment.
22% Days Away From Work

D. 2.2.5 Acting without due care

There were a number of incidents amongst the records reviewed when the causal or contributory mechanism seemed to be the individual performing a task with additional or excessive force. This use of additional force was causal to the event in about a third of these cases.

In approximately half of these cases, the incident classification suggests that the person had employed additional force due to being frustrated. However, the report does not always clarify why the individual involved was frustrated. When the cause of the frustration was more explicit, the following seemed significant causes of it:

- Not being able to complete an apparently easy/ routine the task the first time or after initial attempts

- Frustration with colleagues

D.2 – Table H: Due care – Case Study 1

A worker in a kitchen noticed a potential fire hazard with a pan containing hot oil that had been left on the burner. She alerted her colleagues but was dissatisfied with the reaction and with "abrupt motion" pulled this away from the burner. The oil from the pan spilled causing slight burns on the employee's hand.

The type of injury in these incidents was:
25% First aid treatment
25% Medical Treatment.
38% Restricted Work Case
13% Days Away From Work

D. 2.2.6 Mechanisms versus Severity – Summary

The table below presents the % of the types of illness/ injury caused split by the mechanisms reported above.
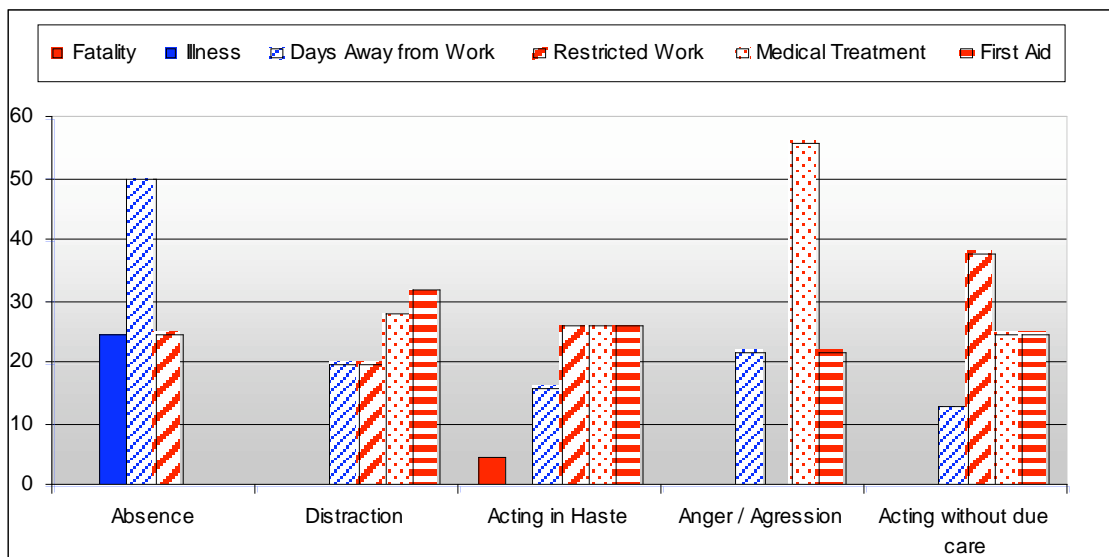
D.2 – Chart A: Incident Severity Categorised by Mechanism

Due to the small number of incidents analysed when split into different mechanism categories, it is difficult to draw any detailed conclusions from these data. However, three observations are:

- A large proportion of incidents involving anger and aggression resulted in medical treatment injuries. This would suggest that behaviours that result in some physical response (and hence the expenditure of energy) to a situation are more likely to lead to result in moderate levels of injury;

- Most of the absence was recorded as illness;

- The only category of mental state that resulted in fatalities was 'Acting in haste'. Although this mental state is not associated with large numbers of fatalities, it does represent 30% of the 15 fatalities resulting from all 229 incidents reviewed for this project.

D. 2.3 Industry Partner Database Conclusions

The analysis of the Industry Partner database revealed the following conclusions:

D. 2.3.1 Psychological ill-health and absence

The database was accessed to find examples of incidents caused by the individual's psychological ill-health, for example the individual was suffering from depression, and this led to their involvement in the incident. The database did include some cases of longer-term psychological distress, all recorded as cases of 'stress'. In these cases, the incident recorded in the database was the related period of absence of the individual from work rather than any actual incident caused by their psychological ill-health or related symptoms.

The incident record did not record enough information on the symptoms to allow a judgement to be made on the severity (i.e. whether these were cases of ill-health as defined in this report). The specific length of the absence is also not recorded but, in all but one case, was more than one day. Work is mentioned as a possible causal factor in all of the cases.

D. 2.3.2 Frame of mind and safety

In the large majority of cases reviewed, the records suggest it was actually the individual's frame of mind at the time of the incident itself that caused or contributed to it. In these cases, there is no reference to the individual's longer term psychological ill-health and the information available in the report suggests that the person's frame of mind was momentary, e.g. they were momentarily distracted.

In addition, in many of the incidents, the reaction itself could be considered normal, i.e. a natural response to the situation and not a sign of ill-health. For example, when reacting to an emergency situation, individuals exhibited signs of increased arousal, sometimes causing them to rush and act in haste. This can be considered a normal reaction and, in situations of emergency, one that is likely to assist the individual more than hinder them.

In some incidents reviewed the categorisation of 'mental state' or 'mental stress' seemed to refer to the fact that the situation posed very high demands of the individual's attention.

There are also a number of other incidents, mostly ones where distraction is a causal or contributory mechanism, where the sources of the distraction or preoccupation had pre-existed

the incident by some time. It is likely therefore that the worry and the impact on the individual's frame of mind could have been affected for some time before the incident though there is no evidence that this had actually caused ill-health.

D. 2.3.3 Committing errors not violations

In the majority of cases, the behaviour that had caused the incident was an 'error' – this means it was not an explicit violation and the person had not intended to behave in that way. Common examples were: people tripping due to lack of attention to what they were doing; people making an error due to having to react quickly to an emergency.

Clear exceptions to this were incidents that involved aggression, such as hitting someone. In these cases, the behaviour that caused the incident had been intentional and not a mistake.

D. 2.3.4 Mixture of cause and contribution

For the incidents reviewed, some had been caused by the individual's frame of mind; in others, this had only been a contributory factor.

Frame of mind was more likely to have caused the incident in cases of anger or aggression or when the individual had had to respond quickly to an unexpected circumstance. In most of the other circumstances, frame of mind was most likely to be a contributory factor to the incident: i.e. the incident would have happened anyway even if the individual was in another frame of mind.

The distinction between frame of mind as a causal and contributory factor is an important one. However, in practice, in some high hazard industries the impact is still going to be significant, regardless of whether this was causal or contributory to an incident. This is because in many such industries the human operator is the primary (and in some cases the only) safety net. Hence, any reduction in performance, whether this is caused or contributed to by psychological ill-health or frame of mind, will represent an erosion of the safety defences, and could lead to an accident.

D. 2.3.5 Causal/ contributory mechanisms

The main mechanisms that explain how the frame of mind had caused the accident were the following:

Causal/ Contributory Mechanism	
Being distracted	By own preoccupations, internal thoughts
	By others/ external events
Acting in haste	Due to other demands, implied haste etc.
	Due to having to respond to unexpected events
Acting in anger	Anger or aggression
Acting without due care	Using additional force, e.g. due to frustration

D. 2.3.6 Severity

Accidents recorded in the database ranged in severity from first aid injuries through to fatalities Overall, the majority of the accidents reviewed had resulted in medical treatment.

It is difficult to draw any more detailed conclusions about differences in the severity of incidents between the different causal mechanisms because of the low number of incidents in each category.

D. 3 EVIDENCE FROM TRANSPORT SECTOR ACCIDENT DATABASE

In order to understand whether the conclusions above could be generalizable to other industries, some publicly available accident databases were also consulted. The transport sector, aviation in particular, maintains up-to-date and easily accessible records of accidents and related investigations. The USA National Transportation Safety Board maintains comprehensive records and their database of airline accidents and incidents was therefore consulted. Records of accidents since 2000 where anxiety or depression, and taking of related medication, where significant factors were reviewed. A total of 44 relevant accident reports were recovered. Of these investigations, about 50% concluded that psychological ill-health was either causal or contributory to the accident itself.

D. 3.1 Severity of accidents

Of the 22 accidents where psychological ill-health was considered causal/ contributory, 30% were suspected suicides. However, even excluding these suicides, 64% of the accidents where psychological ill health was reported as a significant factor resulted in fatalities. This high percentage of fatalities is probably more to do with the nature of the task performed than the effects of psychological ill-health and related symptoms in this particular industry, compared to others.

D. 3.2 Impact of Psychological Ill-health

D. 3.2.1 Presence of medication
Nearly 18% of investigations found presence of medication commonly used in the treatment of psychological ill-health in the body of the pilot or co-pilot. All of these accidents were fatalities.

The presence in the body of anti-depressant medication was found in nearly 60% of cases where depression was mentioned. This was even the case in a few incidents when there was no knowledge that the pilot or co-pilot suffered from depression, e.g. when neither the employer nor the family were aware of the pilot's ill-health.

There was a small number of cases that mentioned individuals suffering from depression but that did not find the presence of any anti-depressant medication. In all of these other forms of mood-altering substances were found: e.g. amphetamines or alcohol.

D. 3.2.2 Frame of mind – Anxiety

In 60% of the investigations that mentioned anxiety, this referred to an occurrence of panic in either the pilot or the passengers, rather than to longer-term suffering of anxiety. These occurrences tended to be those with less severe consequences.

D. 3.3 Aviation Database Conclusions

The sample of accidents was quite small, however, a few conclusions can be drawn.

D. 3.3.1 Lack of clarity of causal mechanism

As in the Industry Partner database, in many of the accidents it was difficult to understand from the report how the psychological ill-health (anxiety or depression) had caused or contributed to the incident. Not enough information was present in the record to make an informed judgement.

This was particularly difficult in cases when the individuals had been taking medication. In these cases, it was difficult to distinguish between the possible effect of the ill-health and the effect of the medication.

D. 3.3.2 Frame of mind: Anxiety and errors

As in the Industry Partner database, some of the cases recorded had been caused by the individual's frame of mind at the time of the accidents, with no indication of longer-term ill-health. These were cases where the individual had experienced anxiety and had panicked. In these cases, it was clear that their frame of mind had been causal to the accident.

D. 3.3.3 Under-reporting of medication use

A major finding in this database is also that people are under-reporting their use of anti-depressants and other medication. Of all the cases where medication was found in the body:

- 6% of people had reported this in their compulsory medical examination
- 63% had actively withheld this information when asked

The rest fell mostly into categories where there was no compulsory medical examination: e.g. student pilots.

The reports of the accidents reviewed did not provide any insights into why information regarding the use of medication was not disclosed. However, it can be concluded that such a level of under-reporting is significant, especially in an industry where there is a culture which embodies compulsory medical examination and reporting, and in which there is a strong focus on understanding human performance limitations in order to prevent accidents.

It is also of note that, in the aviation industry, the list of medications that pilots need to report changes on a regular basis; the onus is placed on the individual to check with their company if they are taking any medication in case it is known to have potential detrimental effects on performance.

D.3 – Table A: Under-reporting - Case Study: 1

There is anecdotal evidence that under-reporting of ill-health does not just affect the aviation industry. For example, in offshore survival training, there is complete reliance on self-certification, however there have been cases when individuals have suffered severe injury (e.g. a heart attack) during training due to not having reported a heart condition.

Staff providing survival training suspect that non-disclosure of medical conditions occurs because individuals fear that if ill-health is reported, this will affect chances to work. There is no direct evidence to support this suspicion, although there was one case identified via a stress study in which the person concerned reported that he needed to go offshore again in order to pay for his daughter to go through college.

D. 4 EVIDENCE FROM INTERVIEWS

To supplement the data collected from accident databases, a series of interviews were also carried out with people who had been involved in an accident or had knowledge of accidents where psychological ill-health was a causal factor.

D. 4.1 Interview Sample

The interviews were carried out with the following groups of people:
- Health & safety advisers
- Accident investigators
- Individuals who had recently been involved in an accident/ incident where psychological ill-health or frame of mind was a cause/ contributory factor.

Volunteers for the interviews were sought among lists of health & safety professionals from a range of industry sectors. Each person contacted was asked if they were aware of any incidents that they had either investigated or been personally involved in, where psychological ill-health or mental state had played a part. They were also asked to forward the request for participation within their own organisation.

A total of 13 people were interviewed, revealing 15 separate incidents from the following sectors. Details of all the incidents are in the Appendix (Section 6.4).

- Aviation;

- Petrochemical;
- Mining;
- Chemical processing;
- Emergency services;
- Local and central government ;
- No specific industry sector (examples from the domestic setting).

Of the incidents reported in the interviews, one could not be reviewed in depth as the individual himself had refused to disclose information relating to his frame of mind on the day. This case is discussed in the Conclusions section; the analysis in the following sections refers to the review of the remaining 14 incidents.

D. 4.2 Analysis of Causal/ Contributory Mechanisms

The 14 incidents from the interviews were discussed jointly to understand the possible causal/ contributory mechanisms. A summary of these is presented below, along with the percentage of incidents associated with each of the causal mechanisms during the review of the industry partner database for comparison.

D.4 – Table A: Summary of Causal / Contributory Mechanisms

Causal/ Contributory Mechanism		% of total	% of total (industry database)
Being distracted	By own preoccupations, internal thoughts	36 %	24%
Acting in haste	Due to high arousal	22%	31.5%
Acting in anger	Anger or aggression	7 %	12%
Indirect impact on others		7 %	N/A
Absence due to psychological ill-health/related symptoms		7%	1.5%

D. 4.2.1 Absence

Two cases of psychological ill-health leading to absence were identified during the interviews.

In the first case the individual has been diagnosed with depression and whilst driving felt that their concentration was being affected. The individual withdrew themselves from work until they felt it was safe to return.

In the second case the individual felt unable to attend work and was later diagnosed with depression.

Neither case resulted in an actual incident, but both demonstrate the importance of maintaining self-awareness.

D. 4.2.2 Being distracted - leading to human errors

In over a third of cases, when assessing how the psychological ill-health had caused the incidents, it emerged that the individuals had been distracted. As in the Industry Partner database, this was the most common way in which an individual's frame of mind caused or contributed to an incident. In the interviews, these incidents all referred to individuals being distracted by their own thoughts and concerns. This had resulted in less attention being paid to the task at hand, leading to errors being made.

The majority of these errors occurred at an early stage in the cognitive process, when the individual is processing information from the outside world. They were mostly errors in sensing information (something was misperceived or not perceived) or judgement (error in predicting of future events, planning or decision making). For example, in one case the individual had driven through a red light saying he had not seen it; in another case, the individual misjudged the distance from the car in front and failed to stop in time.

D.4 – Table B: Case study 1

An individual leaves home angry about problems she is having at home with her partner's relatives. She knows she is frustrated, angry and tired but sets off to drive into work. On the way, she feels distracted by her thoughts and misjudges the distance she has to brake between her-self and the car in front, leading to a minor accident.

D. 4.2.3 High arousal/ anxiety leading unsafe behaviours

There were four cases where it seemed that the individual was experiencing high arousal or anxiety at the time of the incident; in one of these cases the individual explicitly stated that they had felt afraid. In all of these cases the individual's frame of mind had either led them to behave unsafely, either unintentionally or intentionally, and/or had significantly interfered with their task performance.

In two cases, the increase in arousal had led the individual to do something that they did not intend to do (e.g. slip of the thumb, slip of the tongue); these cases were caused by either reacting too quickly or over-reacting to the situation. In neither of these cases did the individuals report anxious thoughts; it seemed to be purely a case of increased arousal which led them to over-react (see Case Study below).

A further incident of this type relates to a very specific frame of mind, being afraid. The individual involved felt that the main impact was distraction, i.e. they found it very hard to stay focussed on the job that they were doing. However, it is very likely that what the person was

experiencing involved high arousal and that this was causal to the experience of thoughts not related to the task.

The final example is slightly less clear as a number of factors were involved: the individual had been driving whilst feeling anxious for some time, possibly leading to fatigue. During the incident, the individual took their attention off the road to engage in a secondary task to save time, something they had done in similar situations before with no negative consequences. This distraction led to a minor accident.

D.4 – Table C: Case study 2

A team is practicing an emergency procedure trying to replicate the exact psychological conditions of an emergency. Arousal levels are high. The individual task is to reverse a vehicle quickly out of a constricted space after two signals.

The first signal comes and the individual mistakenly reverses immediately, running over a colleague. This appears to be a good example of the 'coiling the spring' effect described in section B.

D. 4.2.4 Anger and aggression leading to intentional behaviours

There was one interview that described a series of incidents of a similar nature that had been caused by anger – as described below. What makes these incidents stand out is that they were caused by intentional behaviours, not errors as in the previous cases, but violations of company's procedures and of UK law. These behaviours could have had very serious consequences.

D.4 – Table D: Case study 3

Anecdotal evidence suggests that the expression of anger offshore is not an uncommon event. One situation that has been observed by an HSE inspector on a drilling rig involved personnel from two different contract companies, one providing drillers and another providing services. Both contractors had work to complete on the drill floor, and frustration seems to have arisen because both contractors wanted to get on with their work, leading to conflicts over who had priority. In one case one of the conflicts almost resulted in physical abuse.

D.4 – Table D: Case study 4

An organisation was going through change which involved the loss of work and jobs in favour of a competitor. There was such anger amongst staff about how this change was being managed that several deliberate acts of sabotage were committed on their own and competitor's equipment, including cutting brake pipes on vehicles.

D. 4.2.5 Impacting on others' behaviour

The interviews also revealed an interesting mechanism that had not been found in the Industry Partner database analysis. There was also an incident were the individual's state of mind had influenced the behaviour of people around him in a negative manner.

D.4 – **Table E:** Case study 5
An operations manager needed to phone a shift leader to check and receive information on the progress of maintenance. However the manager knew the individual is about to lose his job due to under-performance and is reluctant to call. Due to this, critical information about maintenance task is not passed on, leading to a potential multiple fatality.

D. 4.3 Interview Conclusions

The following conclusions are drawn from the analysis of interviews only.

D. 4.3.1 Depression leading to withdrawal from work

There were two incidents discussed in the interviews where individuals were experiencing psychological ill-health at the time of the incident (i.e. had been diagnosed with depression). In both the cases, the individuals involved had taken the decision to stay away from work as they felt their ability to perform the job would be impaired.

D. 4.3.2 Frame of mind affecting safety

As in the Industry Partner database, the incidents discussed in the interviews also focused mostly on the impact of the individual's frame of mind, rather than longer term psychological ill-health. In the majority of cases, the incidents had been caused or contributed to by the way the individual was feeling on the day of the incident.

In the majority of cases (67%) reported in the interviews, the mental state of the individual concerned was a causal factor in the incident. This is a much higher percentage than in the accident databases. It is probably due to the fact that the interviewees specifically selected incidents that had involved the individual's frame of mind; it is likely that they choose incidents where this was a key factor in the accident.

The main causal mechanisms that explained how fame of mind led to incidents in the interviews were as follows:

Causal/ Contributory Mechanism
Being distracted by own preoccupations, internal thoughts
Acting in haste due to increased arousal
Acting in anger

D. 4.3.3 Underestimating the impact on routine tasks

Most of the incidents related to errors in routine tasks. This means that the incident was caused by unintentional behaviours and that this happened in tasks that the individual would be likely to complete on a regular basis: e.g. driving to/ from work everyday.

The routine nature of the tasks contributed to the incident as the individuals involved acknowledged that they had either under-estimated the potential impact of their mental state, thinking it would not disrupt their performance, and/ or over-estimated their ability to perform regardless. In these cases, it is possible that, if the task had been non-routine, different or harder, the individuals would have stopped and considered how they were feeling and the impact this could have. If this had happened, the incident could have been prevented.

D.4 – Table F: Case study 6

An individual leaves work late but is frustrated by not having been able to complete some tasks they had planned. He is aware of being frustrated and slightly angry but gets into his car and drives home. On the way home, he narrowly avoids a collision with another vehicle and only then realises that he had just driven through a red light.

D. 4.3.4 Not considering the impact of known causes of psychological distress

In three of the incidents (20%), the individual's mental state was caused by something that had happened at work; it's negative impact was, to an extent, predictable by the organisation. However, the organisation had predicted this and controlled for it only in one case. In the other two cases, the individual had been exposed to a distressing event at work but the organisation had not considered taken steps to minimise the risk from this and the individual had suffered the consequences.

D.4 – Table G: Case study 7

An emergency accident investigation team arrive on site to deal with a fatality. While they are tending to the dead man, they pay no attention to the younger member of staff who was involved in the incident. This younger man blames himself for his colleague's death and other staff later report that he was visibly in a state of shock. When no-one is looking, the individual runs back into the site and commits suicide.

D.4 – Table H: Case study 8

Anecdotal evidence has also been obtained relating to a case in which insecurity regarding employment seems to have been a key factor in a procedural violation. In this case, news on the person's future employment was due out on the day of the incident. During a crane lift, the individual steadied a collar on a riser tensioner by hand, which he knew was a violation of procedure, which seems to have been due to a combination of factors; wanting to be seen to be doing a good job and not wanting to damage the seals that he had been working on. The outcome of the incident was that a collar fell against the operator's hand, resulting in him losing the tip of one of his fingers.

D. 4.3.5 Self-awareness leading to positive behaviour

In three incidents, the individual was aware that their psychological health could be impacting, or was impacting, on their performance and decided to act on this awareness in a positive manner. By doing this, it is likely that they prevented significant incidents.

In two cases, the individuals recognised their performance was likely to be impaired and withdrew from work activities. In the third case, described in more detail below, the individual could not withdraw from what they were doing but managed, through some simple techniques, to regain control over their performance.

D.4 – Table I: Case study 9

An individual was driving on the motorway with her children in the car on a route she was not familiar with. She was worried about the route, especially as the navigation so far had not gone smoothly. One of the children then starts to complain of a possible toothache and the driver starts thinking of how awful this could be and feels her heart rate increasing sharply. The individual recognises the signs of a minor panic attack not, for example, a sign of an impending heart attack, and also realises this must be to do with her psychological state. She remembers from previous training what can help and manages to control her reaction through deep breathing techniques.

D. 4.3.6 Under-reporting and difficulty investigating

In one of the incidents, the individual who worked offshore did not want to discuss their mental state at the time of the accident, even though the incident investigation team felt this was critical to the accident itself. Though this case cannot help understand how psychological ill-health can cause accidents, it is interesting as it highlights two related issues:

- Even when they recognise the signs, individuals themselves may feel under pressure not to report when they are feeling mentally unfit for the job if the working culture does not support it. For example, in this case, it was suggested that the offshore working environment was characterised by a 'macho culture' and did not support conversations about mental health, nor did the organisation have a clear policy about stress etc.

- Even in cases when the investigator suspects the impact of psychological ill-health, it may be difficult for them to gather the information they need to understand how this impacted on the incident. In this example, this difficulty was a result, in part, of the individual not wanting to admit to being stressed and, in part, of the investigators not feeling confident or comfortable with investigating further.

D. 5 SECTION CONCLUSIONS

The review of accident databases and interviews was very helpful in understanding how psychological ill-health has caused or contributed to accidents in the past. The following are the main overall conclusions from this analysis.

D. 5.1 Psychological ill-health leading to absence

In the majority of cases where the individual was experiencing psychological ill-health, such as being diagnosed with clinical depression, individuals withdrew from work and work tasks. There was therefore not a direct impact on safety, though there may be a potential indirect impact due to the resultant reduced manning.

D. 5.2 Impact of frame of mind

In the large majority of incidents reviewed, it was the individual's frame of mind that was causal or contributed to the incident: i.e. the way they were thinking or feeling at the time of the incident itself. This frame of mind was not always linked to longer-term psychological ill-health; this means, for example, that the individual may have had a depressed mood on that specific day and this caused or contributed to the incident but that their frame of mind on the day was not necessarily linked to longer-term depression .

In some cases, the incident was actually caused by a sudden change in the individual's mood – in particular when they experienced anger or an increase in their arousal levels (e.g. an adrenaline rush).

D. 5.3 Distraction leading to human errors

In the majority of the incidents, both in the accident databases and in the interviews, the way that the individual's frame of mind had caused or contributed to the incident had been by making the individual more distracted. This had then led them to commit an error – i.e. an unintentional behaviour - and this had contributed to, or caused, the incident.

In most cases, the distracted individual had principally made errors in sensing information or errors of judgement. Errors in sensing information involved either failing to sense information or sensing information inaccurately or incompletely. In errors of judgement, the individuals did sense the information but made an incorrect judgement about what course of action to take.

What these situations have in common is that they are all errors made "in the individual's head", before any physical action is taken. In this sense, they can be referred to as 'cognitive' errors. Though the individual went on to do something they had not intended (e.g. did not brake quickly enough), the reason for this – the root cause - was in the processing of information relevant to their behaviour (e.g. saw the car in front but thought there would be more time to brake).

The above example is one in which the person doing the job makes an error which results in an undesired outcome. This could equally apply to the situation in which a supervisor makes an error, which leads to them to instruct a worker to do something that results in an incident.

D. 5.4 Arousal leading to human errors

In situations of high arousal, such as being under pressure, feeling anxious or having high levels of stimulation that can lead to an adrenaline rush, the situation is very different. In these cases, the individual was more likely to have correctly perceived and judged the situation (e.g. individual caught in a emergency, knows they need to exit the room quickly and notices the step) but then made an error in their actions (e.g. trips on way out of the door).

In the majority of cases, it is likely that the increase in the person's arousal, and probable increase in adrenaline, was causal to the event: i.e., if the individual had not been anxious or in a state of high arousal, the accident would not have happened.

These increases in adrenaline are the body's way of preparing to either face or escape from a perceived threat, and as such they are a natural reaction. However, these changes are known to have a negative effect on logical thought. These incidents help to illustrate the expected impact of these physiological changes on the performance of cognitive tasks.

D. 5.5 Fear

The case of someone experiencing fear warrants special attention: when people report experiencing fear, they are experiencing a high level of arousal and worry about their own or others' safety. Interestingly, most people tend to report the change in their thinking and are less aware in the physiological changes (i.e. level of arousal). The examples examined in the database and interviews did not provide sufficient information to understand the underlying reasons why fear impacted on performance, however the individuals involved reported higher levels of distraction, and impairment of judgement.

D. 5.6 Anger leading to violations

In both the accident database and the interviews, anger caused intentional aggressive behaviours. This anger was either directed towards the individual (e.g. hitting someone in the face) or towards the organisation (e.g. acts of sabotage on equipment). In all of these cases, the behaviours were clearly intentional and had caused the accident rather than just contributed to it.

D. 5.7 The impact of the organisation

The interviews in particular revealed the significant impact of the organisation on incidents involving psychological ill-health or frame of mind. The organisation influenced the incidents in the following ways:

1. Lack of adequate management of events at work that are known to be distressing, these fell into two categories:

   - Individual exposed to work circumstances which are known to have a potential negative effect on individual mental wellbeing (e.g. fear of redundancy, delivering distressing news, and organisational change)
   - Individuals actually reporting work-related or domestic circumstances as having an effect on their mental wellbeing

In both of theses categories, the organisation had not done enough to control and manage the effect on the individual.

2. Lack of consideration of psychological health: the organisation had taken no proactive measures or put in place policies to assist individuals who may be experiencing ill-health (e.g. stress at work) and there were no attempts to create a supportive culture where the potential consequences of this could be effectively managed.

D. 5.8 The impact on others' behaviour

The interviews also revealed a case when the individual's frame of mind had impacted on others' behaviour, causing them to commit a violation of procedures. In this case, the individual attempted to avoid interacting with the person who was unhappy and possibly angry.

D.5 – Table A: Case study 10

One of the factors that is considered to have contributed to the Trident air crash in Staines in 1972 is the staff's reluctance to intervene in the captain's actions during the flight. This reluctance is thought to have been a combination of the captain's seniority and his frame of mind. This aggressive frame of mind had been witnessed by all when the Captain had been approached by the First Officer in the crew room before the flight and reacted with extreme anger when asked a question regarding some industrial relations issues that he was involved with. Some witnesses to the event described his response as the most violent outburst they had ever seen.

SECTION E - Stressors and causes of accidents and errors

The following section reviews the overlap between causes of psychological ill health at work (commonly referred to as stressors), common root causes of accidents and potential causes of unsafe behaviour (often referred to as Performance Shaping Factors (PSFs)). These terms are further defined in the following table.

	Definition
Stressors	Potential sources of stress
Root Causes of Accidents	System causes of accidents; causes that are not immediate.
Performance Shaping Factors	Conditions external or internal to the person that can, when present, increase the likelihood for an unintentional error.

For the purposes of this research, existing frameworks and models have been used to identify the overlap between stressors, root cause and PSFs. These were chosen on the basis that they are in use by the Health and Safety Executive and/or our Industry Partner, and also have a good theoretical underpinning.

E. 1 WORK-RELATED STRESSORS

In the past few years, there has been extensive research into common causes of stress at work. This section compares different frameworks to develop a comprehensive set of stressors to use for the analyses conducted in this section.

E. 1.1 HSE Stress Risk Factors

The Health & Safety Executive has undertaken significant research into possible sources of stress at work in recent years. A few years ago, they identified 6 common 'risk factors for stress', as presented in the following table:

E.1 – Table A: HSE Risk Factors for Stress

Stressor Factor	Example of content:
Demands	- Quantitative workload (amount of work done) - Qualitative workload (type of work done) - Long working hours - Work environment (e.g. noise, heat etc)
Control	- Control over work pace and work content - Flexible working time - Development of skills
Support	- Encouragement, support from line managers (including feedback) - Encouragement, support from peers
Role	- Role conflict - Role ambiguity
Relationships	- Harassment and bullying - Conflict/ anger at work
Change	- Staff consultation about changes - Clarity over change

E. 1.2 Other Frameworks

The HSE risk factors are compared to other assessment tools and theoretical frameworks to ensure a comprehensive understanding of common sources of stress at work. The table below reports the results of a comparison of 3 frameworks/ assessment tools:

1. Health & Safety Executive Indicator Tool
2. Cox (1993) commonly referred to framework of work stressors
3. The Industry Partner's stress risk assessment methodology

E.1 – Table B: Comparison of HSE stress factors & other frameworks

	Demands	*Control*	*Support*	*Role*	*Relation= ships*	*Change*	*Other*
1.	X	*[1]	X	X	X	X	
2.	X	X	X	X	X	*[2]	*[3]
3.	X	X	X	X	X	*[2]	*[3]

An 'X' indicates a significant overlap in content; a * indicates this a partial overlap. This is explained in more detail below:

*[1]   The risk factor covers both control over work and an element of training/ skill development. The Indicator tool covers the former only.

*[2]   The risk factor and the Indicator Tool cover mainly the communication of change; the other two frameworks cover mostly the amount of change and its management.

*[3]   Additional elements that are not explicitly referenced in the HSE risk factors and Indicator Tool are communications and information exchange between teams/ departments etc. that is not related to change.

E. 1.3 Conclusion

On the basis of this analysis, two modifications to the HSE Stress Factors have been proposed for the purpose of this research:

–   Separating the elements covering training and control in order to differentiate between factors such as control of work pace, and the accessibility of training and development activities.
–   Introducing a separate factor covering communications not associated with change.

The following 8 categories are considered a comprehensive list of potential stressors at work. These will be used in the next sections to determine the overlap with root causes of accidents and conditions likely to increase human error:

- Demands

- Control

- Training

- Support

- Role

- Relationships

- Change

- Communications (not about change)

E. 2 STRESSORS & ACCIDENT CAUSES

The reference used for causes of accidents is the Industry Partner's root cause analysis tool. This tool is well-known in the oil & gas industry as being a comprehensive overview of both system and immediate causes of accidents. It is used by several large, international companies as the basis for their investigations.

Only system causes are included in this analysis as these refer to conditions of work and working practices, rather than the immediate circumstances of the accidents. In this sense, they are more relevant to the current analysis.

E.2 – Table B: Example content of System Cause factors

Accident Factor	Example of content
Personal Factors	- Physical & mental capability/ condition - Individual skill level
Job Factors	- Training - Supervision and leadership - Design & engineering - Work planning, rules, procedures - Tools & Equipment - Communication

E. 2.1 Comparison

The following table indicates with an 'X' where there is significant overlap between the content of the stressor category and the root cause category. An "*" indicates partial overlap.

E.2 – Table B: Comparison between stressors & root causes

System Causes of Accidents	Stressor Categories							
	Demands	*Control*	*Training*	*Support*	*Role*	*Rels.*	*Change*	*Comms*
Personal Factors	X		X		*[1]			
Job Factors			X	X	X		*[2]	X

*[1]   Some causes refer to role conflict and ambiguity, resulting in poor mental state of the individual.
*[2]   Some causes refer to improper management of change.

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E. 2.2 Analysis Results

Based on the table above, the following conclusions can be drawn:

- There is significant overlap between potential causes of stress at work and causes of accidents. The areas of greatest overlap relate to:
    - Role ambiguity: e.g. being unclear about role/ responsibilities;

    - Communications: e.g. not having adequate information about the job/ task or poor communications between teams/ individuals etc;

    - Workload: e.g. having too many tasks to do;

    - Training: e.g. not being adequately trained to do the task.

- There are also areas that are recognised as potential stressors but are not included in the root cause analysis tool. The main ones are:

    - Relationships: e.g. poor relationships with supervisors/ colleagues;

    - Control: e.g. extent of control over their work pace/ content;

    - Change: e.g. broader organisational change.

- Some of the causes of accidents refer specifically to possible symptoms of stress rather than causes.

E. 3 STRESSORS AND PSFs

Another source of information about causes of accidents and incidents is the list of Performance Shaping Factors (PSFs). These are conditions external to the person (e.g. noise, equipment design) or internal to the person (e.g. personal problems, team relationships) that can affect how the person performs on the day, and therefore how likely they are to make an unintentional error.

According to the model of human error used by our industry partner and other organisations in a number of industry sectors, there are 8 categories of PSF, as outlined in table below:

E.3 – Table B: Example content of PSFs

PSF Factor	Example of content:
Task Factors	- Workload, number of tasks - Time pressure
Communications Factors	- Content of messages, language, accent - Quality of equipment
Procedures and Documentation	- Clarity of procedures, compatibility between procedures, how long they have been in use, etc
Ambient Environment	- Noise, temperature, lighting, etc
Training & Experience	- Recency of training, training quality - Level of experience
Human-Machine Interaction	- Workplace layout, equipment reliability, information clarity, etc
Personal Factors	- Boredom, domestic issues, physical health issues, etc
Social & Team Factors	- Team relations and trust - Supervision - Allocation of responsibility

E. 3.1 Comparison

The following table indicates with an 'X' were there is significant overlap between the content of the stressor category and the PSF category.

E.3 – Table B: Comparison between stressors and PSFs

PSFs	Stressor Categories							
	Demands	*Control*	*Training*	*Support*	*Role*	*Rels.*	*Change*	*Comms*
Task Factors	X		X					
Communications Factors	X							X
Procedures and Documentation			X		X		X	
Ambient Environment	X							
Training & Experience			X					
Human-Machine Interaction	X							
Personal Factors			X	X		X		X
Social & Team Factors				X	X	X		X

E. 3.2 Results Analysis

Based on the table above, the following conclusions can be drawn:

- In most cases, PSFs could act as a source of occupational stress as well as an influence on human performance. The areas of greatest overlap relate to:
    - Demands: e.g. number of tasks to be completed; working environment;

    - Communications: e.g. poor or inadequate information about the job/ task;

    - Training: e.g. poor, inadequate or not recent training for the task;

- There are a number of that were partially covered
    - Change: e.g. the impact of procedural change was covered but not that of wider organisational change;
    - Support: e.g. the impact of poor supervision was covered in relation to performance of specific tasks, not more generally.

- There are a number of areas that were partially covered
    - Control: e.g. the extent of control over work content and work pace.

Some of the PSFs refer specifically to possible symptoms of stress rather than causes.

E. 4 CONCLUSIONS

E. 4.1 Summary Comparison

The table below presents the summary of the comparison between stressor categories, potential root causes of accidents and conditions likely to increase error. An "X" indicates significant overlap in content, an "*" partial overlap.

E.4 – Table A: Comparison between stressors, PSFs and root causes

	Stressor Categories							
	Demands	*Control*	*Training*	*Support*	*Role*	*Rels.*	*Change*	*Comms*
Root Causes of Accidents	X		X	X	X			X
PSFs	X		X	X	X	*	*	X

The aim of this analysis was to understand the extent of the overlap between potential sources of psychological ill-health at work, root causes of accidents and performance shaping factors. The following conclusions can be made:

- There is a significant overlap between stressors, PSFs and root causes of accidents. This means that are a number of recognised, well-defined and extensively researched characteristics of work (covering the organisation and design of work activities) that have the potential to cause psychological ill-health that could also cause / contribute to accidents, incidents, unsafe behaviour and errors.

- This research suggests that the main characteristics referred to:

    - Demands: e.g. high workload and high level of task complexity;

    - Role: e.g. role ambiguity, role conflict, etc;

- Support: e.g. lack of support and encouragement from line management;

- Training e.g. inadequate or ineffective training and skill development;

- Communications e.g. lack of or inadequate communications and information.

- There are also areas where there is less overlap between stressors, causes of accidents and human error.

  - Change

    The potential impact of organisational change is recognised as a significant source of stress, but this is not explicitly represented in either root causes of accidents or performance shaping factors. This means that poorly managed organisational change is recognised as having a direct impact on psychological health, but not as being a possible cause of accidents, incidents and unsafe behaviour.

  - Control

    An individual's lack of control over their pace and content of work is not explicitly represented in performance shaping factors or root causes of accidents. However, it is possible that in practice this aspect of work may be considered under 'demands'.

  - Relationships

    There are many aspects of the individual to supervisor relationship that are included in the root cause analysis tool and PSFs, although these are primarily task-focused and do not cover more general poor working relationships that are recognised as potential sources psychological ill-health.

- The root causes of accidents and performance shaping factors both included items describing the psychological state of the individual (referring to the frame of mind at the time of the accident as opposed to longer-term psychological ill-health). This means that there was an explicit acknowledgement of the impact of psychological state on safety. However, the availability of this categorising probably means that, in practice, investigators may limit themselves to indicating this as an issue and would not further investigate the causes of the psychological state.

E. 5 IMPLICATIONS FOR SAFETY

The main implication for safety is that there is a benefit of applying a more integrated approach to health and safety. In practice this could mean using understanding of sources of psychological ill-health to reduce and prevent accidents, for example:

- Research into how to minimise the impact of potential stressors (for example the HSE's management standards) could be of interest and value to those looking to reduce accidents;

- Understanding the links between sources of stress and sources of accidents may lead investigators to further question the causes of someone's psychological ill-health or state of mind when this was a critical factor in an accident. This could in turn lead to more effective recommendations.

A more integrated approach to risk analysis could be used to proactively reduce the risks of both psychological ill-health and accidents, for example:

- The results of an analysis of potential sources of psychological ill-health (for example a stress risk assessment) could also be used to determine and mitigate potential sources of accident risk;

- Conversely, the results of an accident / incident investigation could also indicate a potential risk to psychological health and trigger proactive stress-reduction measures.

SECTION F - Conclusions

The objectives for this research were to:

- Understand how psychological ill health and stress can affect an individual's performance and safety;

- Review how psychological ill-health and stress have influenced or been causal to accidents in the recent past;

- Outline the key implications of this knowledge for industry.

The report explicitly distinguishes between:

- Psychological ill-health - the experience of patterns of feeling and thinking that are: significantly debilitating or distressing and severe and/or persistent;

- Frame of mind – a specific pattern of thinking or feeling, that is a noticeable change to the individual and may or may not be linked to the experience of longer term psychological ill-health.

See Glossary for more detailed definitions of the above terms.

This section provides a summary of the conclusions from this project and should be read in addition to the conclusions of each of the previous sections.

F. 1 MIXED EVIDENCE OF IMPACT OF LONGER-TERM PSYCHOLOGICAL ILL-HEALTH ON SAFETY

The project reviewed evidence for the impact on safety of psychological ill-health, such as clinical anxiety and depression. The literature review showed a series of potential negative effects on performance; these are discussed below and would suggest a fairly strong effect of longer-term ill-health on safety.

However, the review of incidents did not identify many incidents that had clearly been caused by an individual's longer-term psychological ill-health. In some cases the ill-health had resulted in withdrawal from work, in other cases the individual was also taking medication and it was impossible to separate the effect of medication from the effect of the ill-health.

This lack of incidents should not automatically be interpreted as implying that longer-term psychological ill-health does not affect safety but only that this link was not identified during the incident investigations. There are various reasons why this effect may not have been identified and these are discussed below.

F. 1.1 Incidence of psychological ill-health at work

Estimates of the incidence of psychological ill-health in the UK working population vary: for example, the Health and Safety Executive states that about 20% of the working population finds their work very or extremely stressful; other sources indicate that incidence of minor psychiatric disorder in the working population can vary between 16 and 31%.

These figures suggest that there is a significant proportion of people suffering from psychological ill-health at work; but these sources do not provide information on severity of symptoms, and are often based on self-reporting of experiences only. This means that it is difficult to determine the exact nature of the symptoms, their severity and therefore the likely level of disruption.

The most common psychological ill-health conditions reported in the working population are anxiety and depression.

F. 1.2 Clinical ill-health affects safety – in theory

Criteria for the diagnosis of clinical depression and anxiety refer to the persistent experience of a number of debilitating symptoms over a prolonged period of time, the most significant of which are shown in the table below:

F.1 – Table A: Symptoms of Clinical Anxiety and Depression

Generalised Anxiety Disorder	*Clinical Depression*
- Excessive anxiety and worry; - Difficulty controlling this worry; - Difficulty concentrating; - Disrupted attention (e.g. difficulty focusing on more than one task).	- Depressed mood and persistent negative thoughts; - Diminished interest or pleasure, fatigue or loss of energy; - Diminished ability to think or concentrate or indecisiveness.

It is reasonable to assume that the performance of someone who was experiencing the majority of these symptoms regularly or everyday would be significantly affected.

F. 1.3 Possible effects of medication

There is also some evidence in the literature to suggest that performance may also be affected by the prescribed medication taken for depression and anxiety. Patients, some of whom were still at work, reported a negative effect on their performance, and some investigations into fatalities mentioned the presence of medication in the individual involved in the accident.

However, it is difficult to isolate the exact effect of the medication. It is still unclear, for example, whether the effect is additional to that of the ill-health itself, whether it is present but still less than if no medication was taken, or whether patients themselves are confusing the effect of the medication and the ill-health. More research is clearly needed before any firm conclusions can be drawn.

F. 1.4 Withdrawal from work

In some cases of longer-term psychological ill-health, the impact on safety of the individual was minimised as the person withdrew from work and work tasks. The literature review does not specify the likelihood of someone suffering psychological ill-health being absent but commonly reported figures suggest an average of 28.5 days lost per case of stress, anxiety and depression. The review of incidents and the interviews also identified several cases of absence due to longer-term psychological ill-health, in particular, depression.

Though the withdrawal from work may have minimised the effect on safety for the individual, there may be knock-on effects of the consequent reduced manning for the rest of the team. It is also well-known that the management of psychological ill-health related absence presents specific difficulties, compared to other absences, such as: difficulty estimating length of absence, relating to individual on their return etc.

F. 1.5 Weak evidence from accidents/ incidents

In the incidents reviewed as part of this project, the investigation reported on the individual's frame of mind as being causal or contributory to the incident, more than their longer term psychological ill-health. This means that the incident was reported as being caused or influenced by how the individual was feeling that specific day, without making reference to whether this was likely to be linked to longer-term psychological ill-health.

In some of the incidents, it is clear there was no longer-term ill-health: for example, the frame of mind has been changed on that day or just before the incident. In other cases, however, the individual's frame of mind on a particular day could have been influenced by longer term ill-health but this was not mentioned explicitly. For example, someone could have been suffering from depression, this then caused their low mood on a specific day which lead to an incident but their longer-term ill-health was not investigated or reported.

There is therefore a possibility that the effect of longer-term psychological ill-health on accidents and incidents is being under-reported. A number of possible reasons for this are discussed below.

F. 1.5.1 Lack of relevant information-gathering

Common practice in many organisations is to treat the assessment of occupational stress and the investigation of accidents, incidents and near-misses as completely separate activities, often handled by different parts of the organisation. There are also common concerns about interacting with individuals with psychological ill-health, for example fears about increasing their distress.

These two factors could lead to incident investigators not gathering information about longer-term psychological health or ill-health. On the one hand, they may not be aware of the possible impact this may have and be alert to the need to gather this information. On the other, they may lack the required knowledge, skills and confidence to ask questions that would uncover information related to longer-term psychological ill-health.

F. 1.5.2 Under-reporting of medication/ longer-term conditions

The situation above may be confounded by the fact that individuals themselves may under-report their longer term psychological ill-health.

This may happen, in some cases, due to actual lack of awareness of individuals of their own symptoms or of the severity of symptoms. The literature review reported that individuals at work are likely to wait longer before seeking support and this may be partly due to lack of awareness of the need to do so.

On the other hand, there may also be conscious under-reporting of longer-term symptoms due to either the belief that they are not impacting on work performance or the fear of possible consequences of reporting. Individuals themselves may therefore not feel comfortable discussing their longer-term psychological ill-health in the context of an incident investigation. This report

found evidence for the under-reporting of medication use, and it is therefore reasonable to assume that there is a corresponding under-reporting of the conditions for which medication is taken.

F. 2 LIMITATIONS TO EVIDENCE OF IMPACT OF STRESS ON SAFETY

Though some evidence exists of an association between experiencing 'stress' and an increased risk of accident involvement (in particular when driving), the conclusions that can be drawn from this evidence are limited. The main limitations are the lack of clear definitions of what 'stress' means and what 'being stressed' means. For this reason, this report has concentrated more on evidence of the impact of anxiety and depression, both linked to the experience of stress and, more importantly, more clearly defined and understood.

F. 3 STRONG EVIDENCE OF IMPACT OF FRAME-OF-MIND ON SAFETY

The literature and the incidents reviewed in this study both suggest that an individual's frame of mind has an impact on task performance and on safety. This means that the way people are thinking and feeling can cause or contribute to them having an accident, behaving unsafely or committing an error or mistake. A series of specific frames of mind were identified in the review that had either caused or contributed to an incident; these are detailed below.

The effect of some of these states was similar to the effect of longer-term psychological ill-health. This means that the performance of someone who is feeling anxious on a particular day, for example, is affected in a similar way to that of someone suffering from clinical anxiety. The effects are obviously not as severe or debilitating, but there are similarities in their impact.

In addition, the presence of some of these states, including those above, was not necessarily a sign of ill-health but could be considered a natural reaction to the circumstances the individual was in: for example, becoming anxious in an emergency situation.

In summary, the research highlighted the following effects in a non-clinical population:

Feeling…	More likely to …
Stressed	- Be distracted by other thoughts; - Suffer from possible actual diminished ability to control thoughts and actions;
Anxious / Worried / Tense	- Attend to fewer sources of information; - Be more prone to distractions; - Find it harder to focus on a task; - Over-react;
Depressed / Low / Tired	- Find it harder to focus on a task; - Be less interested and less motivated; - Avoid interacting with others; - Find memory is affected;

Angry	-	Act aggressively;
	-	Commit a violation of procedure;
Frustrated	-	Act without due care;
	-	Use excessive force.

The most common effects are explained in more detail below.

F. 3.1 Distraction leading to human errors

The literature review suggested that feeling stressed, anxious or depressed could result in a negative effect on people's attention and task focus. A similar effect was found both in a clinical population and in the general working population: i.e. in people who were suffering to the extent of being clinically diagnosed with either anxiety or depression and in people at work who were feeling depressed or anxious on that specific day.

These effects may explain why one of the main ways in which the individual's frame of mind had caused or contributed to an incident had been by making the individual more distracted. This distraction was most likely to be caused by the individual's thoughts or worries.

Specifically, the incidents reviewed suggest that this had then led them to commit an error in the way they processed information from the outside world, for example, an error in picking up important information or an error in making sense of what this information means. These errors had then contributed to, or caused, the incident.

In summary, this project suggests that one of the main ways in which non-clinical states of mind associated with stress, anxiety and depression can affect safety is by leading to individuals being more distracted and less able to focus on the task in hand. Though difficult to specify an exact mechanism for this, it is likely that this is due to a combination of both actual diminished ability to focus and of the effects of experiencing an increase in non-task-related thoughts. Distraction will then lead them to commit errors in picking up and making sense of information from the world around them.

F. 3.2 Arousal and unintentional unsafe behaviour

Increases in arousal usually occur when needing to raise energy or activity levels to respond to an external stimulation, a perceived threat or challenge. An initial increase in arousal is not always disruptive to performance and, in some circumstances, can be helpful. Releases of adrenaline, increases in heart rate and tensing of the arms and legs, for example, can allow a quicker response to a physical threat by enabling quicker movements.

However, the same changes that allow this quicker response can negatively affect performance in other situations, for example if they are not adequately controlled or if they are prolonged over time or lead to very high arousal levels. The literature review suggested this could lead to over-reacting and less efficient task performance.

The review of incidents did support the potential negative effect of increased arousal. This suggested that, when people are anxious or in situations of high arousal, they will be more likely

to commit a specific type of human error where their actions are not what they intended: i.e. in these situations, the individuals had not made any errors in processing information (e.g. making decisions), but have made an error acting on their decisions (e.g. pressing the wrong button, pulling a lever too soon).

Some of these incidents involved cases where the individual panicked or experienced fear. In these examples, the individuals felt overwhelmed by their thoughts and concerns, and probably, although this is not directly reported, experienced sharp increases in arousal levels. The impact on behaviour was varied, people experiencing fear felt distracted, people experiencing panic usually over-reacted, sometimes with serious consequences.

There was no evidence to either support or refute the finding about task efficiency.

F. 3.3 Anger and violations

The effects of anger on individual's performance were not considered during the literature review as this is not usually considered a type of psychological ill-health. However, anger is a very distinct frame of mind and the review of incidents showed that it had caused accidents and incidents.

In particular, angry individuals had exhibited intentional aggressive behaviours either directed towards another person (e.g. hitting someone in the face) or towards the organisation (e.g. acts of sabotage on equipment).

The interesting feature of the effect of this frame of mind is that this caused intentional behaviours, whereas the effects considered previously were unintentional.

F. 4 WIDER SOCIAL EFFECTS

The literature review focused on the impact on the individual's behaviour. However, it is likely that the individual's frame of mind will also affect the performance of those around them. This could occur in two ways.

In the first place, the literature review suggested that certain types of psychological ill-health will cause the individual to withdraw from social interaction. This is especially true of people suffering from depression or even just experiencing low mood. The consequences of this can be either reduced information sharing and reduced team-working at work or, in more severe cases, an increased workload for others if the individual is absent. The review of incidents supported this to some extent, with a few examples of individuals who had withdrawn from work due to depression. There was less evidence to support or refute a reduced interaction whilst still at work, possibly due to the difficulty identifying this during an incident investigation.

In the second place, the symptoms of psychological ill-health that individuals display may alter the way others interact with them, usually leading to reduced interaction, due to concerns about the individual's reaction: this was identified during the review of incidents. There was one

incident in which this seemed to have led to reduced information transfer between colleagues, a major contributory factor to an incident.

F. 5 COMMON CAUSES – ILL-HEALTH, ACCIDENTS & ERRORS

The report also reviewed common work-related sources of psychological ill-health at work by identifying common causes of stress at work. These were then compared to root causes of accidents and factors that increase the likelihood of errors.

F. 5.1 Overlap in causes

The review identified a number of well-defined and extensively researched characteristics of work and working environment that are potential sources of stress and also have the potential to cause/ contribute to accidents and increase likelihood of errors. This means that identifying known stressors (e.g. role ambiguity, organisational change, etc.) is not only important for maintaining the health and wellbeing of the workforce, but could also act as an indicator of the presence of factors that could result in human errors or accidents.

F. 5.2 Cumulative effect

In practice, the links between these conditions are likely to be even more extensive as it is reasonable to assume that they will have a cumulative effect., e.g. the presence of a source of stress may increase the effect of a performance-shaping factor.

F. 6 TACKLING PSYCHOLOGY AT WORK WILL BRING IMPROVEMENTS TO SAFETY PERFORMANCE

This report aimed to investigate the impact of psychological ill-health – defined as significant or persistent, debilitating or distressing thoughts and feelings that interfere with the carrying out of their day-to-day activities - at work on safety. The literature review and the review of recent incidents undertaken indicated that the scope needed to be extended to also include frame of mind – defined as the way someone is feeling at a moment in time, not necessarily linked to longer-term ill-health.

In conclusion, the report indicates that both psychological ill-health and frame of mind have a significant impact on performance at work and that addressing these and their causes will therefore have a knock-on positive effect on safety.

SECTION G - Recommendations

The following section outlines some implications for safety that arise from the current research; these could be considered simple recommendations for industry.

This section should be reviewed in addition to the Sections 'Implications for Safety' that contain more detailed analysis of the implications of the results of each of the previous sections of the report.

This section splits the implications for safety into three sections – implications at the organisation level, implications for managers and implications for individuals.

G. 1 ORGANISATION-LEVEL

G. 1.1 Integrate approach to health & safety

Several conclusions of this report point to the benefit of an integration of health and safety at an organisational level, these could mean:

- Ensuring people involved in health and safety have a common shared understanding of the impact of psychological health on safety;

- Applying knowledge on how to tackle the work-related characteristics that have been known to cause stress at work to increase reduction of accidents and human error,

- Applying expertise in psychological ill-health during accident investigations, where appropriate (see below).

G. 1.2 Gather further information during investigations

It was clear in the current project that psychological ill-health was not always investigated during accident investigations; this could be due to a number of factors, including lack of understanding of its potential impact and a lack of relevant skills in accident investigators.

Organisations should therefore try to ensure that, when appropriate, the impact of psychological ill-health is fully investigated during accident investigations. This could involve:

- Training accident investigators in understanding how psychological ill-health can impact on safety and what to look out for in accidents;

- Identifying common symptoms of psychological ill-health that, when present in an incident, could act as triggers for a further investigation of psychological ill-health[68];

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[68] *The Industry Partner has undertaken training which includes this component for some of its accident investigators. One mentioned explicitly in the interview that this had enabled him to identify when to probe further in investigations and had resulted in greater understanding of the causes of incidents and better recommendations.*

- Skills training for investigators to be able to ask the 'right' questions – questions that will allow a thorough but not intrusive exploration of psychological ill-health with the individual involved;

- Up-dating accident investigation frameworks to ensure a more detailed analysis is done in cases that could involve psychological ill-health: e.g. prompts in the system that lead to an examination of this angle, possibly linked to specific characteristics of the incident.

G. 1.3 Ensure effective management of distressing events at work

Some of the incidents reviewed were caused by poor management of distressing events at work. It is likely that, had the organisation considered the potential for psychological distress to the individual, procedures could have been introduced to minimise the associated risks.

Organisations need to be aware of the impact of these events on individuals and their performance; for example:

- Introducing procedures for reacting to a major incident which also involve attention to the psychological ill-health of other staff involved or witnesses;

- Ensuring support for individuals who have been tasked with delivering distressing news to others.

G.1 – Table A: Case Study – Managing distressing events

In the British Navy there are some very specific procedures regarding relaying bad news to personnel at sea. In the event that communications are possible (which they may not be in wartime) all communications are received by the radio operator and in the event of bad news from shore, will be passed to the Commanding Officer (CO) rather than the individual concerned. In the case that the news relates to the CO, the message would be passed to the second in command. On board a nuclear submarine, which can remain submerged for long periods of time with intermittent radio communications, the CO has discretion as to whether or not to inform the person concerned of bad news.

There are also support networks for families established for periods of time when personnel are away on exercise or on active duty. Such networks involve establishing a single point of contact (often the wife of the CO) who is known to all concerned. They will then act as a focal point for the provision of assistance to the families of personnel and for communicating with the vessel.

G. 1.4 Consider broader implications of change and uncertainty

In some of the incidents reviewed, the individual's frame of mind, which then resulted in an accident, had been caused by poorly managed organisational change. Poorly managed change in tasks or procedures is well recognised as a possible cause of accidents, however, poorly managed

organisational change is considered to affect only psychological ill-health. This report highlights that it can also cause or contribute to accidents.

Organisations therefore need to be aware of the impact of poorly managed organisational change and job uncertainty on individuals' psychological health and safety. For example:

- Ensure all change and uncertainty is properly managed at an organisational level, with specific attention to psychological ill-health. There are well-known guidelines and principles to ensure the risks associated with change and uncertainty are managed (e.g. HSE Change Stress Management Standard) that organisations could refer to;

- Consider the impact of the change or uncertainty on teams and individuals and allow time for further support or withdrawal from work if necessary.[69]

G. 1.5 Focus on driving

A significant number of the incidents reported in interviews in this report were related to driving, with suggestions from the interviewees that the effect of frame of mind on this particular activity is often underestimated.

In most organisations, there will be significant numbers of people who engage in driving-related tasks, either as occupational drivers or commuting to/ from work. Organisations would benefit from a greater focus on this activity, for example:

- Increasing knowledge in staff, not just occupational drivers, of how frame of mind can affect driving ability; in particular, actively tackling the belief that driving is a routine activity and therefore unlikely to be affected significantly;

- Increase safe driving skills in occupational drivers, including the ability to stop and monitor their frame of mind and react appropriately (e.g. not driving when 'mentally unfit').

G. 1.6 Foster a supportive culture & open reporting

This report found evidence of under-reporting of medication used for psychological ill-health which suggests under-reporting of the illnesses themselves. Common reasons for under-reporting psychological ill-health can include:

- Preoccupation about the consequences of reporting: e.g. stigma associated with mental health; damaging effect of career and promotion prospects; damaging effect on team relationships, etc;

- Under-estimation of the severity of the problem and the potential consequences on performance.

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[69] *During the writing of this report, an example of this behaviour was identified. An OIM had stopped an offshore team from continuing work after an announcement of possible redundancies due to concern about the possible effect on the team's stress levels and safety performance.*

Under-reporting of psychological ill-health is detrimental in an organisation as it reduces the organisation's ability to control for the possible consequences: this can mean both not being able to manage the effect is has on performance and wellbeing at the current time and not being able to act early to prevent a worsening of the situation.

Organisations would therefore benefit from taking clear, strategic action to increase awareness of psychological health at work and it's impact – both positive and negative – and take steps to address any stigma associated with suffering. Raising awareness should be well managed and the information given to staff precise and useful. It should carefully distinguish between ill-health (i.e. clinical levels of symptoms) and frame of mind, and specifically aim at challenging common misunderstandings such as "all stress is ill-health."

G. 2 MANAGEMENT-LEVEL

G. 2.1 Incentives for regular stress risk assessments

It is a requirement in UK law that companies undertake regular risk assessments of hazards at work, including potential sources of stress. A risk assessment would involve identifying significant sources of stress at work for a team and taking action to reduce or control these as reasonably practicable.

This report emphasises that there will be beneficial effects on safety of this activity both from reduction of ill-health itself and also by tackling possible sources of accidents. This may provide an additional incentive to managers who may not be convinced of the value of assessing for stress in their teams.

G. 2.2 Task-focus

A generic stress risk assessment will look at current sources of stress within teams: issues that are present and have the potential to cause stress. However, this report has also emphasised the effect of frame of mind on individual tasks; this may be something that a stress risk assessment does not focus on. It is therefore suggested that organisations would benefit from including a focus on frame of mind at the level of the task, for example, checking everyone is focussed, that there are no potential distractions etc. This could become part of the usual process of preparing for a task.

G. 2.3 Understanding & responding to symptoms

This report also emphasises the need for managers to become more aware of common symptoms of both psychological ill-health or of staff's frame of mind to ensure the safe performance of tasks. Managers could play a key role in identifying when staff show signs of distraction or anger, for example, which may impact on their ability to fully concentrate of the task.

Increasing awareness in managers of these common states that could affect safety at the level of the task should include both:

- Description of key symptoms and their significance, including precise distinction between frame of mind and ill-health;

- Training in how to respond most appropriately to common, disruptive frames of mind, such as frustration.

For example, managers could be educate about anger, how it is usually manifest and how to deal with an angry employee.

This type of education could be done alongside a more general training on psychological ill-health at work, including attention to common symptoms and how to respond to people who are suffering from depression or anxiety.

G. 3 INDIVIDUAL-LEVEL

G. 3.1 Importance of self-awareness

This report suggests that individuals would benefit from greater awareness of the impact of their emotions and frame of mind on their performance. In particular, they would benefit from becoming more aware of change in the way they were thinking: e.g. becoming more angry, feeling an increase in heart rate due to worry, and understanding what this means and the most appropriate way to respond.

Increasing self-awareness for individuals could be done in a variety of ways, for example, training for individuals to recognise common frames of mind that can affect safety performance, including physical and psychological indications that frame of mind may be affected. This awareness would also need to include simple actions for individuals to take to manage their psychological state[70].

It would also be necessary to add to the results of this report from either sector-specific or task-specific investigations into the impact of psychological ill-health or state of mind on performance.

It is unreasonable, however, to expect increased self-awareness alone to have a significant impact as it is likely that, in some situations, individuals would find it hard to detach themselves from the situation enough. It is therefore important that any programme also included attention to how to recognise signs in others and how to respond, for example using a 'buddy' system.

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[70] *Training courses of this nature, if available, should be adopted with consideration of the specific tasks for which they are intended.*

G.3 – Table A: Case Study – CRM

In the aviation industry Crew Resource Management (CRM) training is used to train pilots to improve their overall situation awareness (i.e. knowing what is going on around you) and to be aware of the potential impact of changes in performance associated with attention, vigilance, fatigue, stress and workload. It should be noted that a number of studies into the effectiveness of CRM have been conducted in the aviation industry, with mixed results. Some organisations report significant improvements in safety performance as a result of CRM, others report much less significant or negligible impact.

It would be beneficial to develop training based upon situation awareness training and the awareness training for the effect on performance of attention, vigilance, fatigue, stress and workload tailored to the specific requirements of the industry to include training on self awareness and the awareness of the performance of others, with specific focus on the effects of psychological ill-health and state of mind. The inclusion of practical, simple actions that individuals can take to manage their psychological state would be necessary. An example of this kind of intervention is CRM training, (see CAP 720[71] and CAP 737)[72].

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[71] *Reference 47*
[72] *Reference 48*

APPENDICES

1. 1 ACCIDENT DATABASE CLASSIFICATION

1.1.1 Mental State

Sub-Classification	Accident Database Notes
Emotional Disturbance	*The incident happened because the person involved was emotionally disturbed*
Fears or Phobias	*The incident happened because the person had a fear or phobia*
Influenced by medication	*The person's mental state was diminished due to the side effects of medication*

1.1.2 Mental Stress

Sub-Classification	Accident Database Notes
Preoccupation with Problems	*The person involved in the incident was preoccupied with problems and was not fully concentrating on the activities in progress*
Frustration	*The incident happened because the person involved was frustrated*
Emotional overload	*The person was under high stress from either work or personal issues that affects their emotional state*
Extreme boredom	*The person is affected by monotonous or repetitive work*
Extreme Judgement / Decision Demands	*The work being done required judgement and decision making that created stress, e.g. time-sensitive decisions, high stakes in the outcome, incomplete information in which to base the decision*
Memory Failure	*Although the person involved was well-trained at the time of the incident, the person could not remember how to act or react*

1. 2 RESULTS OF INITIAL ANALYSIS OF ACCIDENT DATABASE ENTRIES

1.2.1   Mental State:

Sub-Classification	Incident Analysis results
Emotional Disturbance	For the majority (34%), the report did not contain enough information to understand the classification. In 20% the classification referred to the individual expressing anger or aggression. In a further 10% the incident resulted as consequences of a 3rd party's actions (not necessarily linked to psychological ill-health). A further 10% the individual was acting in haste either due to responding to the unexpected or due to perceived haste. The rest were a mixture of different causes.
Fears or Phobias	For the majority, the report did not contain enough information to understand the classification. For those accidents where it did, it seemed the incident itself had caused the fear or phobia and not vice-versa: i.e. the fear had not been causal to the incident.
Influenced by medication	Only 2 incidents reported the influence of medication as a factor in the causation of the accident. In both cases there was insufficient information to understand the classification.

1.2.2   Mental Stress

Sub-Classification	Incident Analysis results
Preoccupation with Problems	In the majority of cases (48%), the incident report did not contain sufficient information to understand the classification. In 16% of cases it was clear that the individual had been preoccupied by their own concerns, rather than by the actions of another person. 7% of cases involved the individual doing things quickly (for example due to perceived time pressure or other demands).
Frustration	In 61% of incident reports there was insufficient information to understand the classification. Approximately 18% of incidents were due to the individual either applying additional force (9%) or acting in an aggressive manner (9%). Approximately 13% of incidents were due to the actions of a third party, and were not therefore within the control of the injured party.
Emotional overload	In 31% of incidents there was insufficient information to understand the classification. A further 25% of incidents were not written in English and were not therefore used. In 2 incidents (12.5%), there was evidence of a stress-related illness causing or contributing to the accident.

Sub-Classification	Incident Analysis results
Extreme boredom	There were only 5 incidents in this category, 40% did not contain enough information to understand the classification, a further 20% were not in English and were therefore not used. Two incidents provided sufficient information for further analysis. One was the result of fatigue, whilst in the second case a poor mental state was observed following the incident (i.e. it was neither causal nor contributory).
Extreme Judgement / Decision Demands	Of the 25 incidents that fell into this category, 40% provided insufficient information to understand the classification, a further 8% were not in English and were not used. 16% were due to the individual acting in haste due to a response to the unexpected. 12% were due to the actions of a third party over which the injured party had no control.
Memory Failure	Of the 17 incidents reviewed, 82% of them held insufficient information to be able to understand the classification. Of the remaining three incidents, 1 was due to the actions of a third party that the injured party had no control over, 1 involved aggressive behaviour on the part of the injured party, and 1 was due to distraction by others or external events. All of the incidents in this category were from 2002 and 2003, there were none from 2004 or 2005.

1. 3 DETAILS OF 2ND STAGE ANALYSIS

1.3.1   Analysis undertaken

The incidents were reviewed by two psychologists independently with efforts made to ensure the classification of both would be compatible. Half the incident reports were reviewed by both psychologists, with subsequent discussion about any discrepancies in judgement.

A classification system was introduced to standardise the interpretation of individual incidents. The rest were reviewed by one of the two psychologists independently.

1.3.2   Distinguishing between cause and contribution:

The criterion that was applied to determine whether or not the behaviour of the individual was causal or contributory was whether or not the incident would have occurred in the absence of that behaviour.

For example, an injury sustained as the result of being punched in the face by an aggressive colleague would not have occurred if the colleague had not been aggressive, and therefore this behaviour was causal to the incident.

On the other hand, a person who trips over a step buried under snow whilst preoccupied with worries about their family could still have tripped if they were not preoccupied, although the preoccupation may have contributed in some way to the incident, hence this would be considered contributory.

1. 4 SUMMARY OF SME INTERVIEWS

No.	Error/ Intentional	Industry Sector	Task	Was the task routine?	Mechanism/ Description	Mechanism	Cause/ Contribution	Result	Lessons Learned at the time	Would self-awareness have helped?
1	E	No specific sector	Driving to work	✓	The individual was distracted as was thinking about personal issues; they also seemed to be distracted by other things happening outside car. Did not slow down quick enough	Distraction/ Judgement error	C	Bumped into the car in front.	Should have waited before starting drive to work to calm down. But considers the accident 'inevitable' as she did not believe that her mental state was going to significantly affect her driving.	✔
2	E	Petrochemical	Moving equipment.	✓	Individual had been told he was going to be made redundant but was still offshore and expected to carry out duties regardless.	Distraction (anger?) (Perception)	O	Fall on stairs.	Wait until the end of an offshore trip to give such bad news. Deliver the news in a more sensitive manner. Management or others to be more aware of how others are feeling. Give people time off when in difficult situation.	X
3	E	Local & Central Governement	Driving in exercise .	?	During practice for an emergency procedure. Individual was in high arousal state and did not wait for appropriate signal before moving the vehicle.	Adrenalin rush /high arousal (Judgement error)	C	Ran over colleague.	Train people to recognise the effect of arousal and be able to control it.	✔
4	E	Emergency services	Driving.	✓	Person felt at greater risk due to being in a depressed mood. Decided to stop work.	Lost concentration due to depression.	0	None – work was stopped.	Continually ask: 'am I fit to work?'. Be aware of own frame of mind.	✔
5	E	Petrochemical	Man-machine interaction task.		Individual decided to continue with a task even though they were uncertain about how to do it. Possible perceived pressure/ high arousal, reacting too quickly without consideration/ "asking for help".	Reacting too quickly (Judgement error)	C	Blow-out in furnace.	Frame of mind of the operator can affect behaviour and lead to 'irrationality'. It is difficult to self-monitor and take a step back to consider how own frame of mind may be affecting decision.	✔

No.	Error/ Intentional	Industry Sector	Task	Was the task routine?	Mechanism/ Description	Mechanism	Cause/ Contribution	Result	Lessons Learned at the time	Would self-awareness have helped?
6	E	Local & Central Governement	Driving.	✓	Individual was asked to deliver distressing information to a 3rd party. When driving away felt distracted and driving on "autopilot".	Distraction – loss of concentration (Perception error)	C	Near collision avoided by 3rd party action.	Be aware of own frame of mind. If in doubt, don't drive.	✔
7	I	Mining	Suicide.	X	Individual played significant part in a fatality at work. Though they were only doing what all other staff would have done (poor safety culture) felt very at blame and committed suicide.	Extreme distress.	C	Fatality	Need to ensure emergency procedure to support people who have been involved in an incident.	
8	E	Aviation	ATC	✓	Controller was preoccupied by personal issues and did not check her understanding of a colleague's message – expectation bias played very strong role.	Loss of situational awareness due to preoccupation with problem. (perception error)	O	Loss of separation by two aircrafts.	Maintaining awareness of the impact of personal factors on own performance. Being critical of own capacity to cope.	✔
9	I	No specific Industry	Driving.	✓	Whilst slowing down, took eyes off the road to look at a map. Had been anxious and in state of high arousal for whole journey and there was the distraction of kids in the car.	High arousal	O	Bump.	Reduce stimulation in the car. Take different map in car and check system before setting off.	✔
10	I	No specific Industry	Driving.	✓	Whilst driving unsure of where to go and with a lot of arousal/ stimulation from radio and kids, felt the onset of a panic attack.	Knowledge + self-awareness, confidence in knowledge and skills.	C	Recovery from panic attack.	Knowledge of symptoms and awareness that this was caused by psychological state and not a medical condition. Confidence in own abilities to calm down.	✔
11	I	Local and central government	Providing counselling.	✓	Individual felt unable to attend work and provided counselling for another due to being depressed due to mis-management of change at work.	Self-awareness	C	Individual did not go to work and patient did not receive treatment.	Better change management and consultation about job security. More awareness of the natural reactions to uncertainty so don't feel 'abnormal'.	✔
12	I	Aviation	Sabotage.	X	During time of organisational uncertainty, acts of sabotage were committed on equipment, including sabotaging of car breaks.	Anger	C	Faulty equipment. Stop of work.	Need to better manage organisational change and be aware of possible impact.	X

No.	Error/ Intentional	Industry Sector	Task	Was the task routine?	Mechanism/ Description	Mechanism	Cause/ Contribution	Result	Lessons Learned at the time	Would self-awareness have helped?
13a	I?	Aviation	Handover.	✓	Individual was known to be unhappy about losing their job. The person's mood meant other person did not want to talk to him and did not make handover communication.		C	Key information not handed over.	(see below)	?
13b	E	Aviation	Handover.	✓	When the 2nd opportunity to handover the critical information came about, the person who was going to loose their job missed this info out.	(unclear whether intentional or error)	?	Runway incursion; potential plane/ vehicle collision.	Need to recognise and act on risks associated with psychological ill-health: e.g. assign individual to lighter duties.	✔
14	E	Petrochemical	Driving	✓	Leaving work with unfinished projects on mind. On "Auto pilot"	Distraction (Perception error)	C	Ran through red light.	Difficult to prevent as did not think that state of mind was going to impact on driving so much.	✔
15	E	Petrochemical	Lifting	✓	The supports for a load were taken away during a routine job.	Unclear	?	Injury	Company told to introduce policies and procedures to ensure better management of stress at work.	

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GLOSSARY

Psychological ill-health	The experience of patterns of feeling and thinking that are: - Significantly debilitating or distressing for the individual: e.g. interfere with the carrying out of their day-to-day activities; - Severe and/or persistent: e.g. meet DSM-IV-TR criteria for mental disorder in terms of severity and duration.
Frame of mind	A specific pattern of thinking or feeling, that: - Is a noticeable change to the individual; - May or may not be linked to the experience of longer term psychological ill-health (e.g. feeling a bit down).
Stress (psychological ill-health)	The experience of patterns of feeling and thinking that: - Develop within 3 months of onset of exposure to psychosocial stressor/s; - Are clinically significant: i.e. produce significant distress or cause significant impairment.
Stress (frame of mind)	The adverse reaction people have to excessive pressure or other types of demand placed upon them (from HSG 218)
Stressor	Potential cause of stress
Human Factors	Environmental, organisational and job factors, and human and individual characteristics which influence behaviour at work in a way which can influence health and safety
Arousal	The activation of the mind and body to respond to external events – for example on hearing a loud noise a person may experience tensing of the muscles and feeling suddenly more focused.
Human error	A behaviour which was *not intended*, which involved a deviation from an accepted standard and which lead to an undesirable outcome
Violation	A *deliberate* deviation from a rule or procedure
Stressor	Potential sources of stress
Root Causes of Accidents	System causes of accidents; causes that are not immediate.
Performance Shaping Factors	Conditions external or internal to the person that can, when present, increase the likelihood for an unintentional error.

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