riskinsight

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Fatigue Hazard Analysis

Task Hazard Analysis in the *context* of fatigue.

The inclusion of a human impairment (Fatigue) in Risk Management Processes and application of the Zurich Hazard Analysis in these processes.

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Fatigue is a significant cause of accidents and incidents in a broad range of industries including road transport, aviation, rail, sea-borne cargo, mining, manufacturing, building, hospitality and healthcare. A nurse working a double-shift accidentally gives a patient the wrong drug or dose, a tired kitchen-hand drops a knife, a weary manufacturing plant supervisor doesn't notice something's amiss on the production line.....

And a lack of sleep has been a contributing factor in many serious accidents, including:

- the Chernobyl nuclear reactor meltdown (lack of action by shift workers in the early hours of the morning led to disastrous consequences)
- the Exxon Valdez oil spill (fatigue and excessive workload contributed to failure of the third mate to properly manoeuvre the vessel)
- the Waterfall train derailment in NSW, Australia (fatigue limited the train crew's ability to respond when the driver was incapacitated)

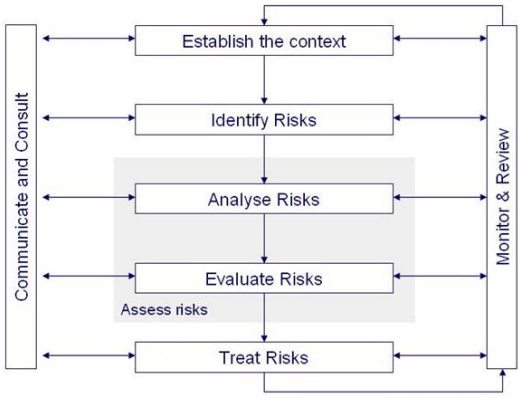
Up until recently, risk engineers were reluctant to assess fatigue within an organisation's total risk gradings, primarily because of a lack of scientific understanding about its causes and impact. While they were aware of the dangers posed by fatigue, risk engineers did not have a rigorous basis for capably assessing the risk.

This is not the case any more, with insurers increasingly placing emphasis during the underwriting process on the adequacy of an organisation's fatigue safeguards for a wide range of high-hazard industries.

In response to this InterDynamics, in partnership with Zurich Risk Engineering, has developed FaidSafe® – a process of Risk-based Integrated Fatigue Management (RIFM), with the Zurich Hazard Analysis at the very core of this process. In order to better understand Fatigue Hazard Analysis we must first overview RIFM.

Risk-based Integrated Fatigue Management (RIFM)

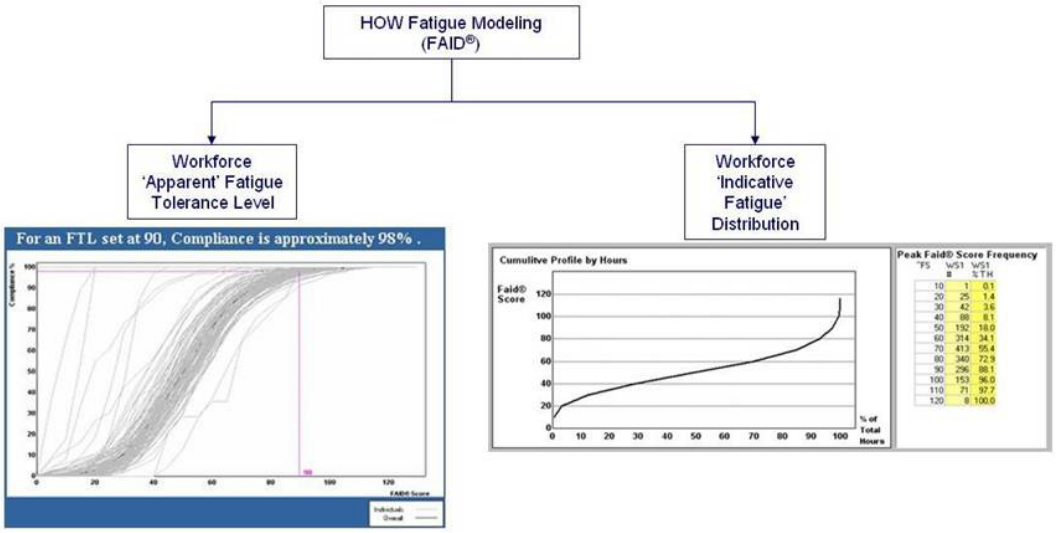
RIFM utilises the framework of AS / NZS 4360, CAN/CSA-Q850-1997, BS 6079-3:2000



1. Establish the 'context'

Fatigue is the context of how we look at the hazard of the task (i.e. task hazard). Fatigue is not the hazard. Hence, this is really task risk management in the *context* of fatigue.

To establish this context, it is necessary to first gain an appreciation of the indicative fatigue level amongst the organisation's workforce. This is achieved by determining the 'apparent' Fatigue Tolerance Level – FTL via analysis using a scientifically-proven fatigue model. In the case of FaidSafe®, this model is Hours of Work (HoW) based and is called FAID® (Fatigue Audit InterDyne).



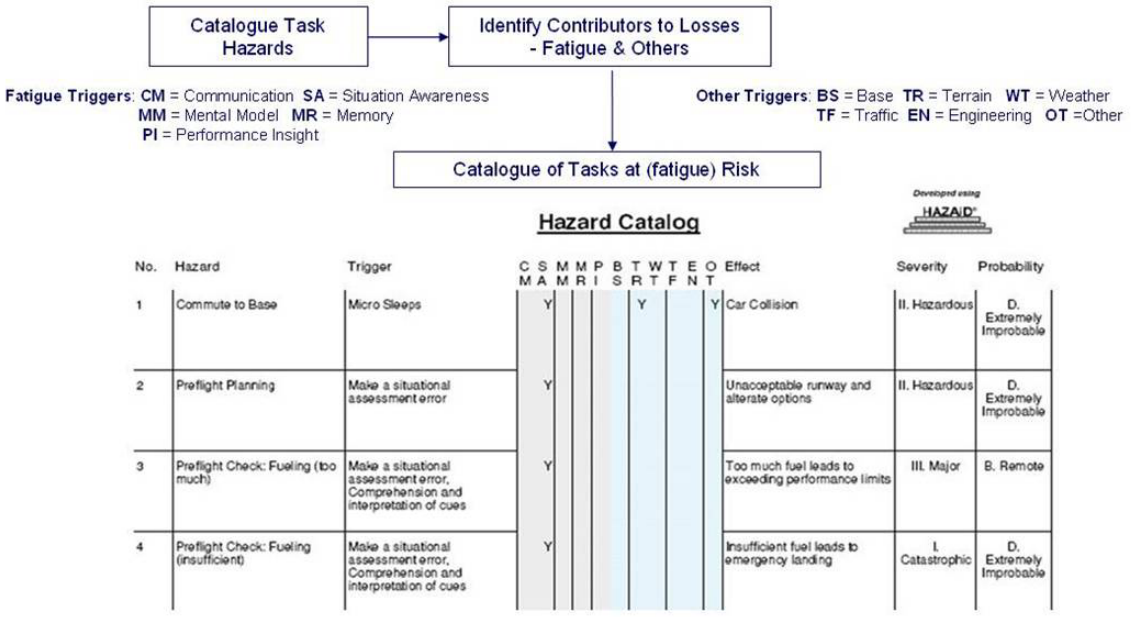
For the diagram on the left - if an FTL of 90 is set in FAID® and the model indicates 98% compliance, it can be deduced that this is the indicative fatigue level for the organisation.

The diagram on the right shows percentage of total hours worked that fall below the range of indicative fatigue levels.

2. Identify Risks

After defining the risk parameters of severity and probability for the organisation (i.e. in the organisation's terminology), the task hazards are catalogued using an 'enhanced' ZHA methodology (HAZAID™) that is specifically designed for Fatigue Hazard Analysis (FHA) which also groups 'triggers' to better facilitate development of controls.

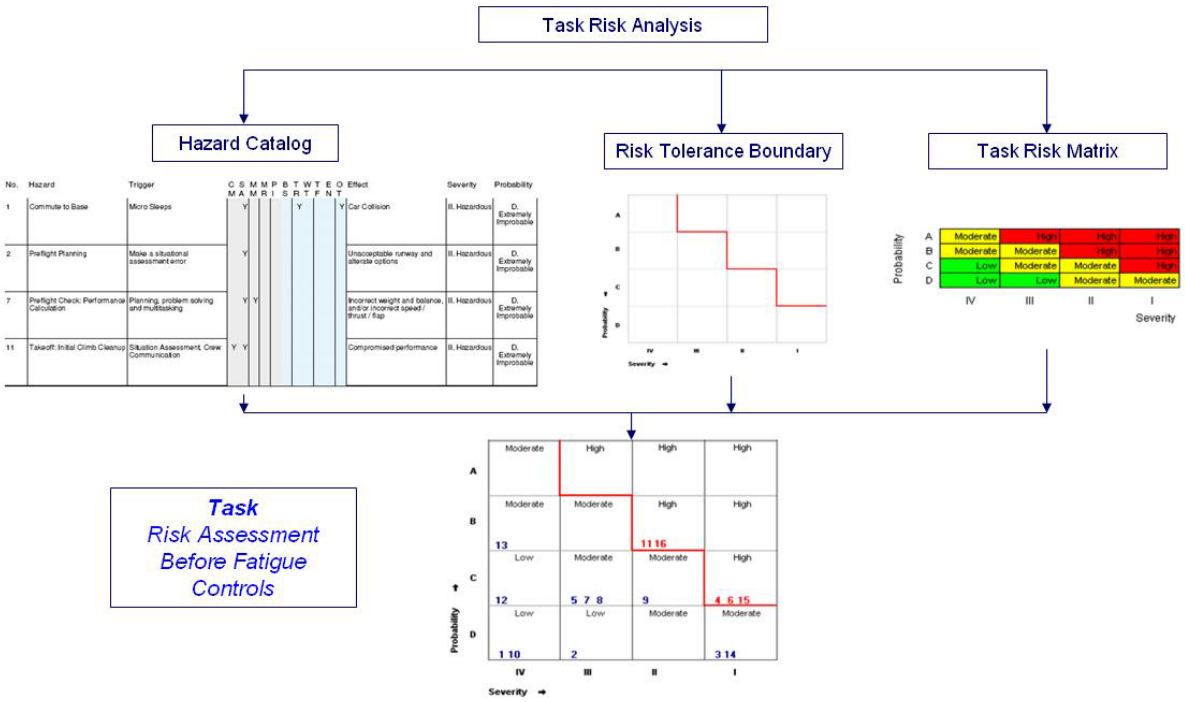
ZHA is the preferred methodology due to its ability to provide rigour in identifying hazards via pathways and ticklers for relatively intangible 'tasks' (in the context of fatigue). .



No.	Hazard	Trigger	C M	S A	M M	M R	P I	B S	T R	W T	T F	E N	O T	Effect	Severity	Probability
1	Commute to Base	Micro Sleeps		Y					Y				Y	Car Collision	II. Hazardous	D. Extremely Improbable
2	Preflight Planning	Make a situational assessment error		Y										Unacceptable runway and alterate options	II. Hazardous	D. Extremely Improbable
3	Preflight Check: Fueling (too much)	Make a situational assessment error, Comprehension and interpretation of cues		Y										Too much fuel leads to exceeding performance limits	III. Major	B. Remote
4	Preflight Check: Fueling (insufficient)	Make a situational assessment error, Comprehension and interpretation of cues		Y										Insufficient fuel leads to emergency landing	I. Catastrophic	D. Extremely Improbable

3. Analyse Risks

In line with ZHA principles, the Risk Tolerance Boundary (RTB) of the organisation is determined and then the RTB and output of the Hazard Catalogue are plotted on a risk matrix.

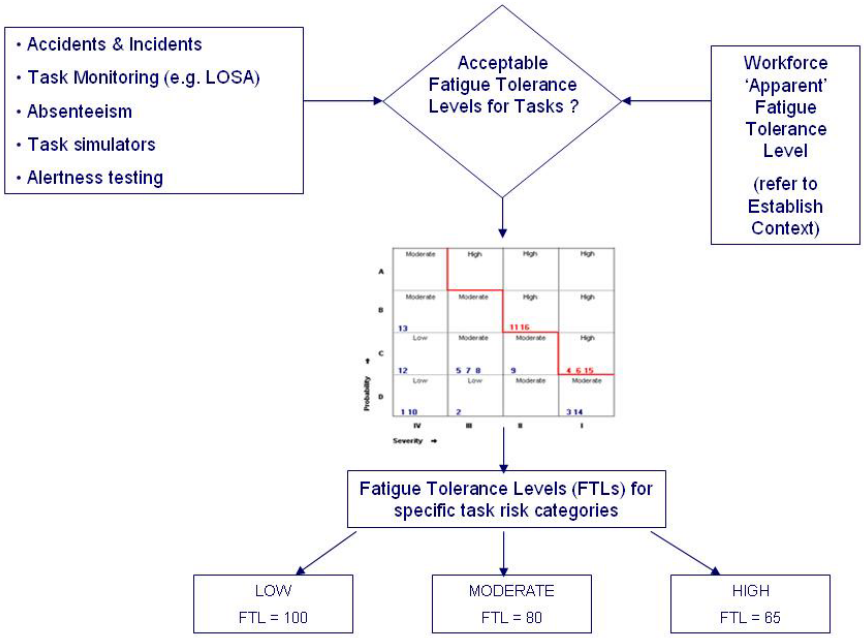


4. Evaluate Risks

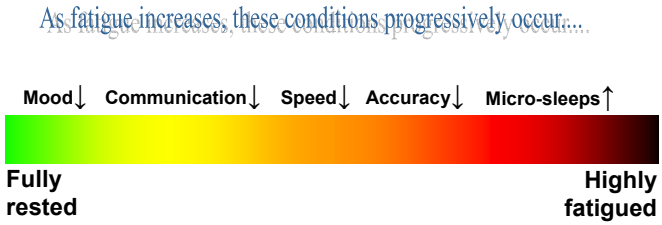
In order to evaluate these task risks (in the context of fatigue), performance measurement of current / proposed service and safety outputs across the organisation is conducted at known fatigue levels using the following data;

- Accident and incident analysis
- Task monitoring / observation (e.g. Line Operations Safety Audit - LOSA, used in aviation)
- Staff absenteeism
- Simulators
- Alertness tests

The probing question here is "Is this performance acceptable for each business unit / operation?" Once this is answered, then proceed to focus on the least acceptable performance(s) and establish 'actual' FTLs for business units / operations with unacceptable performance.



To better enable this performance, employees should also be consulted to review how happy, alert and well-rested they feel (bearing in mind that the more fatigued an individual is the more fatigue may impair one's ability to self assess). It is important to remain aware of the progressive consequences of increasing fatigue during these consultations with employees as these often are good indicators of fatigue.

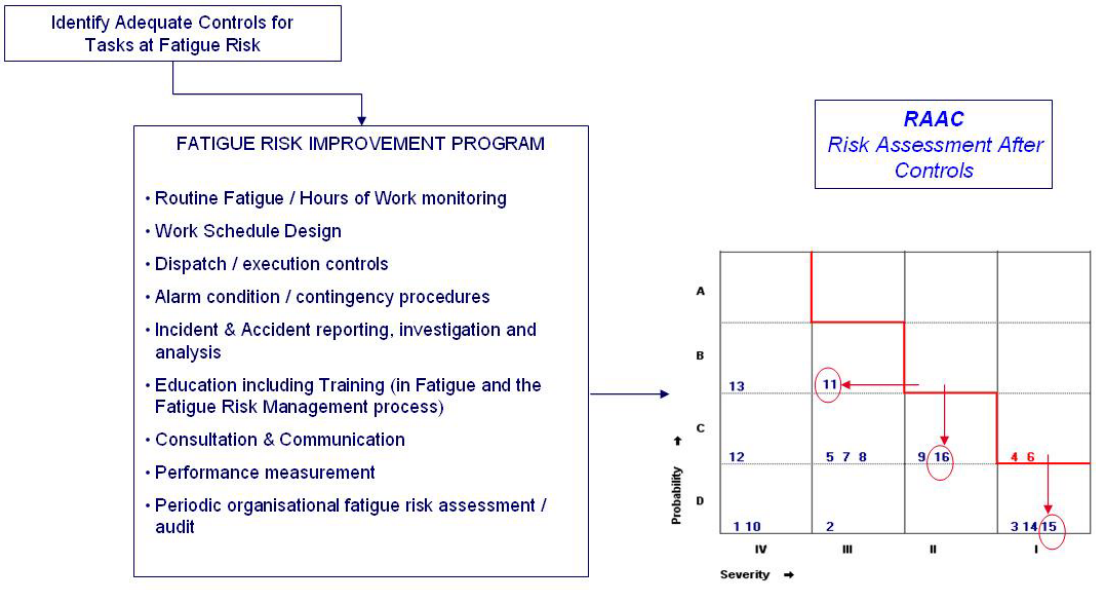


4. Treat Risks

Risks are treated by deploying current Fatigue Management tools but based on a Risk Management framework to improve tasks / jobs at risk of fatigue to an acceptable level;

- Routine Fatigue / Hours of Work monitoring
- Work Schedule Design
- Dispatch / execution controls
- Alarm condition / contingency procedures
- Incident & Accident reporting, investigation and analysis
- Education including Training (in Fatigue and the RIFM process)
- Consultation & Communication
- Performance measurement
- Periodic organisational fatigue risk assessment / audit

There is nothing new in this list of tools, they have all existed for many years. However, it is uncommon for organisations to apply these tools under the disciplined framework of Risk Management.



It should be noted that there are only two effective ways to address unacceptable fatigue-related risk;

- Reduce fatigue levels

AND / OR

- Reduce the task demand (make less onerous / demanding)

Fatigue Hazard Analysis (application of ZHA) – Its role in RIFM

The main shortfalls with traditional Fatigue Management are;

- Prescriptive limits for sleep, rest and work duration fail to acknowledge variations in job / task demand and inherent coping strategies (i.e. controls) and provide little or no operational flexibility.
- 'One rule for all', whilst appealing in simplicity, means that operations with less demanding jobs / tasks may be unnecessarily restricted and operations that have evolved good inherent coping strategies lose competitive advantage.

This is why there is an undercurrent of dissatisfaction with prescriptive work / rest times – especially in the road transport industry.

RIFM overcomes these shortfalls by:

- Determining the acceptable fatigue limit for each specific job / task taking into consideration the inherent coping strategies that have evolved.
- Structuring work activities (whilst at the same time considering non-work activities) so that normal operations are within these acceptable fatigue limits for each job / task.
- Entrenching fatigue monitoring systems and alarm points to notify before breaches of these limits occur.
- Establishing contingency procedures / increased controls for operations above the acceptable fatigue limits for each job / task.

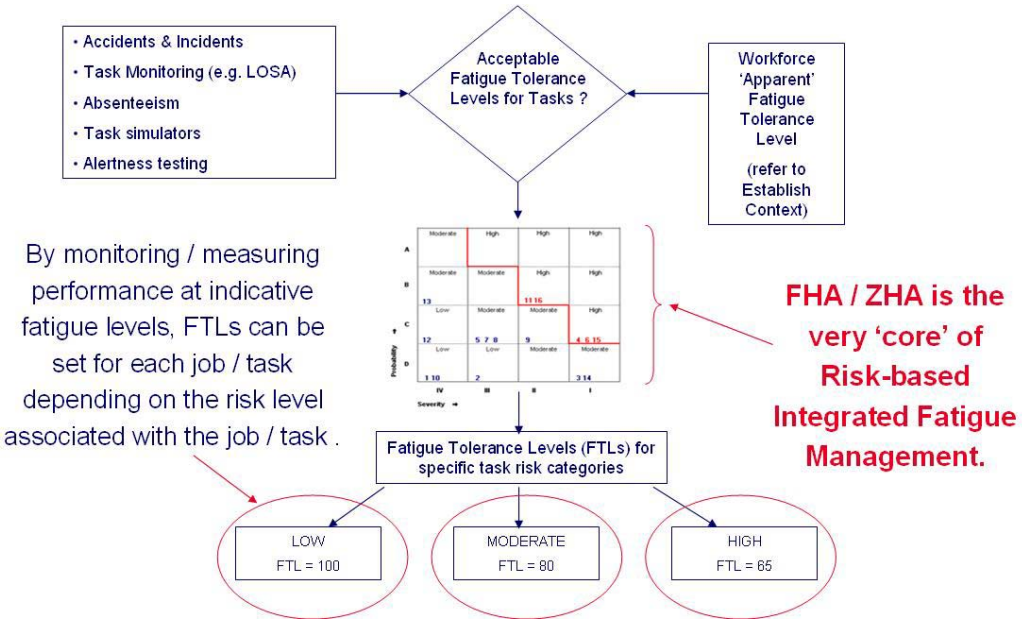
The old school approach of just 'making sure you get a good night's sleep' is not enough. Whilst sleep management is indeed crucial, many people today are being asked to perform beyond / outside their natural body rhythms. Hence, it is necessary to embrace the fact that everyone gets tired, and manage the risks associated with this.

The difficulty with the RIFM process is the first item – determining acceptable fatigue limits. All other items seem possible with current tools and systems but how do we determine acceptable fatigue limits for each specific job / task taking into consideration the inherent coping strategies that have evolved?

Fatigue Hazard Analysis (FHA)

Fatigue Hazard Analysis is the 'key' to the solution of determining acceptable fatigue limits. However just as fatigue is not the hazard (it is the context of how we look at the hazard of the task), FHA is not really 'Fatigue' Hazard Analysis.....but rather Task Hazard Analysis in the context of fatigue.

Hence, it is Task Hazard Analysis in the context of fatigue that enables job / task specific acceptable fatigue limits to be determined using rigorous, proven risk management methodology. It is an integration of existing tools and systems rather than a completely new system.



Just as Hazard Analysis is the principal tool of Risk Management, Task Hazard Analysis *in the context of fatigue* is the principal tool of Risk-based Integrated Fatigue Management (loosely referred to as "Fatigue Risk Management"). It enables the following;

- Clear identification of unacceptable / high-risk tasks
- Focus areas to review / reset FTLs
- Facilitation of the two main risk treatment tools (reducing fatigue levels and reducing the task demand)

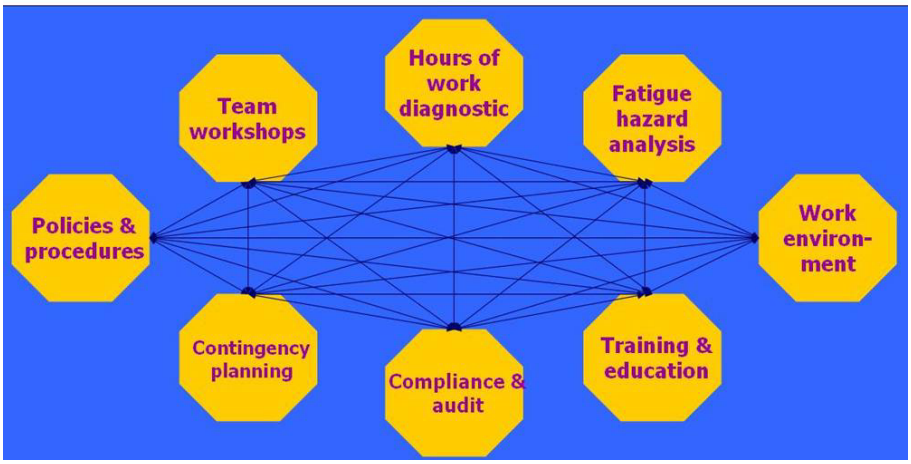
Some further thoughts on RIFM

Most industries and organisations are yet to integrate their Fatigue Management efforts and hence operate under a disjointed model of Fatigue Management.

Fatigue Management (As previously applied) - *poor integration of elements*

However, with the aviation industry leading the way, the integrated approach of 'Fatigue Risk Management' is gaining acknowledgement across to other industries.

Risk-based *Integrated* Fatigue Management - *Each element informs / adds to others*



Like all effective control systems, FaidSafe® relies on multiple levels of control / protection / safeguard for adequacy.

Systematic Multi-level Safeguards

- **FaidSafe® Level 1 Safeguards**

Primary protection is achieved by developing fatigue safe work practices and rosters, which significantly reduce fatigue-related risks. The program helps individuals and organisations identify and analyse hazards and design systems to address them. It includes a diagnostic to compare planned work hours against actual figures – an eye-opener for many organisations.

- **FaidSafe® Level 2 Safeguards**

Secondary levels of protection are achieved by developing competencies for managing fatigue-related risk at an operator and management level, together with the use of systems to monitor compliance with fatigue safety standards. Workforce and management training and education, compliance monitoring and reporting procedures are integral to this level of protection – and useful for demonstrating an employer's duty of care.

- **FaidSafe® Level 3 Safeguards**

Tertiary levels of protection are achieved through the development of contingency and emergency competencies to cope with high-risk situations when individuals experience high levels of fatigue. Risk assessments, utilising a fatigue-related risk grading (GRAID™) are used to monitor fatigue-related risk profiles and to determine priorities for further improvement.

Why RIFM?

Even a well / best-designed roster does not provide adequate protection from fatigue-related risk. RIFM incorporates the collection of multiple measures of fatigue (predicted, actual, acute and cumulative), fatigue surrogate variables (e.g. workload, roster variables) and improved metrics for assessing human performance (for example low-risk on-board data gathering events). This information will assist in determining a Fatigue Tolerance Level appropriate for the operation and form the basis of a continuous monitoring program to support risk detection and evidence-based change.

Summary

- Risk-based Integrated Fatigue Management (RIFM) is the process of adequately managing fatigue based on an integrated risk management framework.
- Fatigue Hazard Analysis (FHA) is the 'key' to RIFM.
- FHA is not really 'Fatigue' Hazard Analysis.....but rather Task Hazard Analysis in the *context* of fatigue.
- Just as Hazard Analysis is the principal tool of Risk Management, Task Hazard Analysis *in the context of fatigue* is the principal tool of RIFM.
- The Zurich Hazard Analysis (ZHA) is at the very core of the RIFM process – it is the tool that enables Task Hazard Analysis in the context of fatigue.
- Previous efforts of disjointed 'Fatigue Management' are mostly not effective and need to be integrated into a risk management framework to adequately manage fatigue.