Strål säkerhets myndigheten
Swedish Radiation Safety Authority

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Leadership in safety critical industries: Project Report 1

Literature Review

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SSM perspective

Background

Both leadership and management have a strong impact on a safety culture. 'Management' is for example seen by the Swedish Radiation Safety Authority as the management of strategies, goals and activities. 'Leadership' deals with culture, teamwork and individuals and is therefore a culture driver. For the Authority, it is important to ensure that the licensees have a focused leadership for safety work and that the leadership supports and develops a strong safety culture. For a regulatory body, evaluating leadership is obviously more difficult than evaluating management. However, with the strong connection between leadership and safety culture, SSM has determined that it would be of great value to enhance the Authority's capability to evaluate safety leadership aspects and organisations approach to lead development efforts directed at safety work. SSM decided, as a proactive step, to procure a study focusing on the identification of challenges in connection with leadership and development of leaders. This procured research project is meant to contribute to reflection and understanding of the importance of leadership in safety work, both for licensees and for the regulator.

Objectives

SSM defined the following objectives for the research project:

- identifying and analysing factors, good practices and challenges of leadership and leadership development for managers in safety critical industry (nuclear power, aviation, etc.), and
- identifying and analysing relevant approaches and factors to enable supervision and understanding of leadership for safety from a regulatory perspective, and to enable evaluation of the leadership and its impact on safety culture.

Results

The two project reports give a thorough overview of the state-of-the-art in leadership for safety.

Project Report 1, the literature review, covers a broad spectrum of leadership aspects and several safety critical industries starting off with the concept of safety leadership, beginning with reference to its origins as part of safety culture. This forms a solid foundation for organisations for taking into account different models, tools and approaches when dealing with leadership.

The review also describes a range of processes that can be used to obtain information about the nature and quality of safety leadership in an organisation. These processes are described in five categories:

- review of three approaches for evaluating the performance of individual leaders
- survey techniques for gathering data on safety-related beliefs, attitudes, knowledge and behaviour
- examples of multi-faceted approaches to improve safety leadership as part of a broader safety culture enhancement project
- the utility of safety event analysis as a source of information on the quality of leadership performance
- the benefits and limitations of safety assessment processes.

Furthermore, the first report describes some of the approaches and processes commonly used in hazardous industries to develop Safety Leadership. Examples are summarised under five categories:

- the 360 degree feedback approach, designed to develop leaders, managers or supervisors through individual feedback;
- toolkits or comprehensive packages of resources
- Safety Culture enhancement projects that incorporate leadership development elements
- information and guidance material, often provided online, including for example written material, conference proceedings and video
- formal education and training programs, and other techniques for sharing safety experience.

Project Report 2 covers the result of the Safety Leadership survey and the analysis is a valuable source of information for future safety work and leadership evaluation and development. The authors summarises selected examples of safety leadership models developed in a range of high-risk industries. The content in the examples could be readily adapted to develop a more formal safety leadership competency framework.

The authors also discuss four key challenges for a regulator in monitoring the quality of safety leadership:

- How to define and evaluate safety leadership
- How to support the development of competent safety leaders in the future
- How to detect anomalies and vulnerabilities in leadership
- How to embed in corporate memory the lessons from operational experience.

The second report is concluded with 15 recommendations resulting from the study. These recommended actions for SSM are set out in four categories:

- Action within SSM, representing initiatives that SSM can undertake inhouse that are designed to improve capability to monitor safety leadership
- Future Industry Directions, a set of recommendations on ways SSM can influence licensees to improve the way safety leadership is evaluated and developed
- Cooperative Development Projects, indicating potential ways in which SSM might collaborate with industry to develop new or improved tools for developing safety leadership
- Ongoing Support, indicating areas where SSM can continue to support current industry approaches to Safety Culture enhancement and safety leadership development.

The recommendations for the regulator will be useful in the ongoing work to develop supervisory strategies and activities.

Need for further research

SSM does not see any need at this time to conduct further research on the topic of leadership for safety.

Project information

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This report concerns a study which has been conducted for the Swedish Radiation Safety Authority, SSM. The conclusions and viewpoints presented in the report are those of the author/authors and do not necessarily coincide with those of the SSM.

Contents

1. Introduction

This document is the first of two reports prepared on behalf of the Swedish Radiation Safety Authority (Strålsäkerhetsmyndigheten, SSM) for a project entitled 'Leadership in safety critical industries'.

This first report is a literature review of the topic of Safety Leadership, which is seen as a key component and driver of safety culture.

Following this introduction, the literature review contains five main sections.

Section 2 explains the concept of safety leadership, beginning with reference to its origins as part of safety culture. Various definitions of the term, as used in safety-critical industries are reported. Evidence supporting the notion that different behaviour may be relevant and successful at different leadership levels of an organisation is presented. Finally, research on the relationship between leadership and safety performance is discussed.

Section 3 reviews the way safety leadership is defined, understood and utilised to support safe performance in a selection of safety critical industries throughout the world.

Section 4 presents selected examples of safety leadership models developed over the past 30 years in high-risk industries. The models range in scope and format from quite structured competency frameworks through to simple descriptive lists of leadership qualities and attributes. Requirements for such models to be useful in supporting safety leadership evaluation and development are discussed.

Section 5 reviews a range of approaches to *evaluating* safety leadership across the industries described in Section 3. These include: approaches designed to evaluate the performance of individual leaders; survey techniques used to gather data on safety-related beliefs, attitudes, knowledge and behaviour of employees; examples of multi-faceted approaches to improving safety leadership, typically as part of a broader safety culture enhancement project; analysis of safety events, as a source of information of the quality of leadership performance; and lastly safety assessment processes, including self-assessments and peer reviews.

Section 6 documents and reviews a selection of the numerous methods used to develop safety leadership as a competence for managers and supervisors in safety critical organisations. The methods covered include: the 360 degree feedback technique; toolkits and information packages; Safety Culture enhancement projects, where leadership development is addressed; various forms of information and guidance material, including online, written and video material; formal education and training programs, and other techniques for sharing safety experience.

The second phase of this project involved providing advice to SSM on approaches for ensuring effective safety leadership amongst leaders at different levels in the Swedish nuclear power industry. A second report describes this phase of the project, which included a global survey of safety experts across various industries on issues and best practice in regard to safety leadership, consultation with SSM personnel, and interviews with workers and managers at one Swedish nuclear power plant. The guidance on safety leadership evaluation and development in the Project Report 2 report draws directly on industry 'best practice' as described in this literature review.

2. The Concept of Safety Leadership

This section examines the concept of Safety Leadership from four perspectives: its origins as a component of safety culture; the definitions used in different industries and in research; the significance of leadership styles and leader behaviour at different management levels; and the influence of leadership on safety performance.

Origins in Safety Culture

As is often reported, the term *safety culture* was first used by the International Nuclear Safety Advisory Group (INSAG) of the International Atomic Energy Agency (IAEA) in 1986 following a detailed review of the Chernobyl nuclear power plant accident (International Nuclear Safety Advisory Group, 1986). Since that time, safety culture has been the focus of considerable discussion and research, much of it focussed on defining exactly what safety culture is, then trying to identify culturally based changes that can make an already safe organisation even safer. Research reports on a safety culture enhancement project conducted for the former SKI (Lowe & Hayward, 2006; Lowe, Axelsson, Hayward & Branford, 2008) review some of these safety culture definitions and associated research over the past 25 years.

The importance of safety leadership has long been recognised in the safety culture literature. Most definitions of safety culture emphasise the integral influence of an organisation's leadership group on the safety attitudes and behaviour of employees. For example, Flin (2001, p. 7) argues that safety culture is in fact "determined by perceptions of management commitment to safety, as judged by the workforce" and that any efforts towards safety culture improvement must begin with measuring the perceived management commitment to safety.

Gaba and colleagues (Gaba, Singer, Sinaiko, Bowen & Ciavarelli, 2003, p. 173) suggest that the term "safety culture" describes those aspects of an organisation's reliability that depend on "shared values and norms of behaviour *articulated by senior management* and translated with high uniformity into effective work practices at the front line" (emphasis added).

The IAEA has stated that "safety culture has to be inherent in the thoughts and actions of all the individuals at every level in an organization" and that "the leadership provided by top management is crucial" (International Atomic Energy Agency, 1998, p. 3).

Hopkins (2002) also refers to the critical role played by management in establishing and maintaining a positive safety culture, asserting that:

> It is *management* culture rather than the culture of the workforce in general which is most relevant here. If culture is understood as mindset, what is required is a *management* mindset that every major hazard will be identified and controlled and a *management* commitment to make available whatever resources are necessary to ensure that the workplace is safe. (p. 5).

Figure 1 below shows the model of safety culture developed for SKI in the Safety Culture Enhancement project referred to above (Lowe & Hayward, 2006). The model is derived from the work of Reason (1997) and Hudson (2003), and features

six fundamental elements of safety culture. As can be seen in Figure 1, management commitment is depicted as the central and most influential element of the model.

Figure 1
Management Commitment as
the Central Element of Safety Culture

Safety leadership frequently involves implementing and driving change within organisations. Bowen and Bigda-Peyton (2011), in their review of outcomes from the fourth annual 'Safety Across High Consequence Industries' (SAHI) conference, contend that leadership from management is a critical component of successful change implementation in high-consequence industries, and that "inadequate or misaligned leadership approaches may doom even the most well-intentioned or essential organisational changes" (p. 16).

They cite a highly relevant example from James C. Taylor of Santa Clara University, who worked for many years with the technical operations divisions of several major US airlines to help migrate the safety benefits associated with Crew Resource Management (CRM)[1] training to the airline maintenance environment:

> For example, implementation of a maintenance resource management (MRM) training program designed to improve aviation maintenance safety initially showed positive, enthusiastic support on the part of maintenance technicians; however, Taylor (1998) reports that several months after training initialisation, these same technicians voiced frustration and anger with the program, citing a lack of support and clarity from leadership on the application of the training. (Bowen & Bigda-Peyton, 2011, p. 16).

As noted by Taylor elsewhere (2000), "successful change requires unequivocal top management support". He cites a positive example of this from Continental Airlines, where the leadership and support displayed by very senior management led to the establishment of their highly successful MRM program. Not only did the idea for the

[1] Further discussion of the safety benefits associated with various adaptations and applications of airline-style CRM training can be found in Sections 3 and 4 below.

development and implementation of the training program originate from the top of the maintenance organisation, it was also very well resourced and supported by top management, sending a powerful message to employees.

As Taylor observes, the case at Continental Airlines showed that if a senior executive "dedicates himself to that vision long enough, if he is persistent in its visible sponsorship, and if he is clear in the conviction that scientific evaluation of the program will improve its acceptance and continued development as well as validate his vision, then results occur" (2000, p. 209-210). Taylor also noted that following their involvement in this training, participants reported that the program, unlike most others they had experienced, really worked, and that they believed that top management support for the program was genuine.

Patankar and his colleagues (Patankar, Brown, Sabin & Bigda-Peyton, 2012) have accumulated significant experience working with safety culture in aviation and healthcare, and recently proposed a 'safety culture pyramid', depicted in Figure 2 below, as a contextual framework for understanding and interpreting the concept of safety culture.

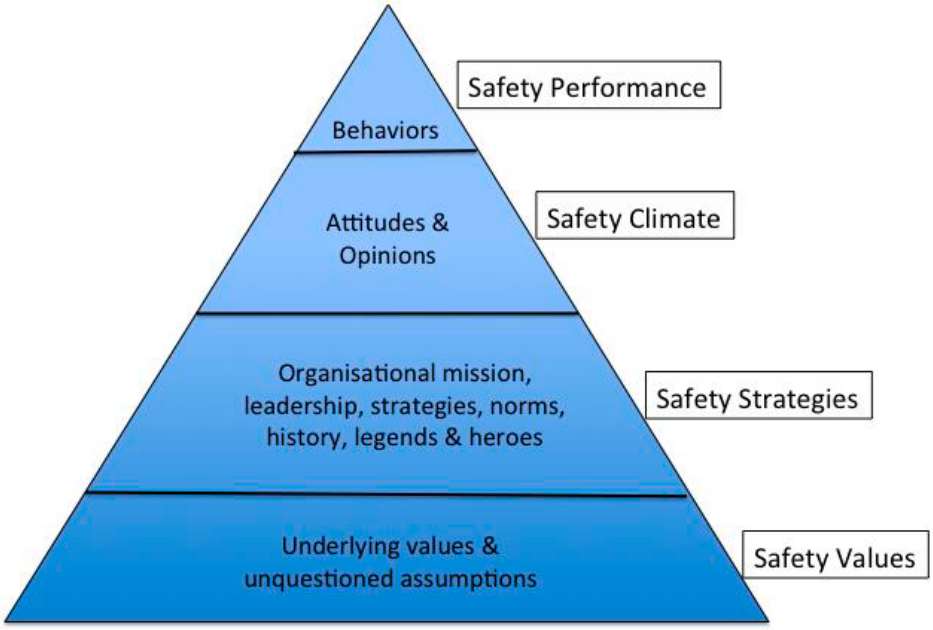

Figure 2
The Safety Culture Pyramid
(Redrawn from Patankar et al, 2012)

Patankar and colleagues view safety culture as a state of dynamic balance between the four, stacked, layers of this pyramid. At the tip of the pyramid is safety performance (safety behaviours), followed by safety climate (employee attitudes and opinions about safety), and safety strategies (leadership strategies; organisational mission, values, structures and goals; policies, procedures and practices; history, legends and heroes), with safety values (shared underlying values and unquestioned assumptions) forming the base of the pyramid.

Patankar et al regard safety leadership as an important influence on 'safety strategy', one of the four core components of their safety culture pyramid. They believe that safety leadership in high-consequence industry "is about creating an environment in which safety will be practiced as an enduring value" (2012, p. 115), with the values

and assumptions forming the foundation of the safety culture pyramid being "lived" by the organisation's leaders. As they observe, this is consistent with the definition of safety culture provided by the Institute of Nuclear Power Operations (INPO, 2004) as, "an organisation's values and behaviours – modelled by its leaders and internalised by its members – that serve to make nuclear safety the overriding priority."

It also appears that the significant influence on safety performance exerted by leaders permeates cultural boundaries: In a review of cross-cultural research on organisational safety, Mearns and Yule (2009, cited by Eid, Mearns, Larsson, Laberg & Johnsen, 2012) presented empirical evidence suggesting that proximal influences such as management's perceived commitment to safety and the efficacy of safety measures influence workforce behaviour and accident rates more than fundamental national values.

Defining Safety Leadership

Recognition of the critical role of managers and leaders in regard to the establishment and maintenance of positive safety culture has led to further research and consideration of what safety leadership entails in practice and the influence that the attitudes and behaviour of leaders can have on operational safety. This section discusses definitions of safety leadership used in safety critical industries and in research, and describes some of the sub-elements used to characterise the concept.

As noted by Eid and colleagues (Eid et al, 2012) in a recent 'theory-driven' literature review, several academic disciplines take an interest in leadership, with numerous models discussed in the literature of social psychology and organisational psychology. While definitions of safety culture abound, and leadership is often explicitly included, there are few attempts to define exactly what is being discussed under the appellation safety leadership.

Leadership per se is a topic that is vigorously debated with respect to many aspects of modern life, including politics, society, corporations, and the military, on the sports field and within any form of work team. There are many definitions of leadership, but as summarised by Northouse (2010), four components are central to the construct. They are: (a) Leadership is a process; (b) leadership involves influence; (c) leadership occurs in groups; and (d) leadership involves common goals. This leads to the following pithy definition:

> "Leadership is a process whereby an individual influences a group of individuals to achieve a common goal" (Northouse, 2010, p. 3).

Flin, O'Connor and Crichton (2008, p. 131) report that the term 'safety leadership' is gaining currency with industry, and that it refers to "managers' and supervisors' leadership behaviours in relation to safety outcomes."

Attempting to advance discussion of the safety leadership construct, Guselli (2010) adapted Maxwell's (2005) definition from the mainstream leadership development literature, to define safety leadership as:

> "…the process of persuasion or example by which an individual induces another person or group to pursue safety objectives held by the leader and shared by his or her followers."

ConocoPhillips, one of the world's largest energy exploration and production companies, regards safety leadership as a key responsibility of line management and

in 2009 rolled-out a program to provide Safety Leadership Seminars for employees and supervisors across the company. Within those seminars they defined safety leaders as follows:

> "A Safety Leader is a person who cares enough to take the action to keep themselves and others free from danger or injury through guidance, persuasion, direction and/or setting the example." (ConocoPhillips, 2009).

Geller (2001) writes extensively about the 'psychology of safety' and distinguishes the characteristics of safety leaders from regular managers as detailed in Table 1 below.

Table 1
Characteristics of 'Managers' versus 'Safety Leaders'
(Adapted from Geller, 2001)

Managers	Safety Leaders
Hold people accountable	Hold people responsible
Train	Educate
Speak first, then listen	Listen first, then speak
Answer questions	Ask questions
Promote compliance	Promote ownership
Direct by edict	Inspire by example
Use unconditional statements	Use conditional statements
Mandate roles and policies	Set expectations
Manage what's measured	Facilitate intangibles
Limit choice	Encourage choice
Enable mindlessness	Facilitate mindfulness
Follow a directive approach	Instruct, support, coach or delegate

Professor Rhona Flin and her colleagues at the Industrial Psychology Research Centre (IPRC) at the University of Aberdeen, Scotland have been studying safety culture and its application to various industries, including offshore exploration for oil and gas and healthcare, for many years.

In an early paper on error management in the offshore industry, Flin (2001) notes the importance of visible management commitment to safety, a key safety leadership indicator. She suggests that senior managers who are concerned about demonstrating their commitment to safety should ask themselves the following questions about their behaviour and interactions with staff in the workplace:

- Are you making time for safety?
- Do you allow your staff to take their time to do the job safely?
- Are they encouraged to stop the job and have a 'Time Out' for safety?
- Do you take the time to listen to safety concerns?
- Do you have time to spend at the worksite?

All of these factors relate to management making time to engage with their workforce about safety matters. As observed by Flin: “Why is time so crucial? Because it is the strongest signal of commitment from busy managers with little time to spare.” (2001, p. 5).

In more recent times the IPRC have focussed their attention on attempting to identify the “active ingredients” for successful safety leaders (Flin, 2010). The reason for this is that public enquiries into numerous major industrial safety accidents, including Three Mile Island, Clapham Junction, the Herald of Free Enterprise, the Piper Alpha offshore oil rig fire, the Ladbroke Grove rail crash, the Challenger and Columbia space shuttle accidents, the BP Texas City refinery explosion, Colgan Air flight 3407, and BP’s Deepwater Horizon Gulf of Mexico oil platform disaster, have consistently emphasised the role of managers and their leadership in influencing safety, for better or for worse.

While these Aberdeen IPRC research projects are ongoing and yet to deliver final results, they are currently examining a number of issues related to the characteristics of safety leadership, including ‘Influence from the top: Senior managers and safety leadership’ (Reid, Flin, Mearns & Bryden, 2008), ‘Safety leadership: A view of the senior managers’ role’ (Roger, Flin, Mearns & Hetherington, 2009), ‘Development of a safety leadership tool for senior managers’ (Roger, Flin, Mearns & Hetherington, 2010), and the ‘Safety intelligence of senior managers and safety outcomes’ (Fruhen, in preparation).

Levels and Styles of Safety Leadership

It is important to recognise that leadership in safety does not originate exclusively from senior management. As discussed by Patankar and his colleagues, opportunities to take a leadership role are not limited to top management and exist at all levels of an organisation: “Whether you are a frontline employee, a middle manager or the President/CEO, you have opportunities to demonstrate your commitment towards safety” (Patankar et al, 2012, p. 115).

In their Safety Leadership Seminars for employees and supervisors, ConocoPhillips also emphasised the point that safety leadership is not something that is restricted to management: “Any individual in the organization – ConocoPhillips or Contractor – from the least experienced to the most experienced – from the oldest to the youngest – can be a Safety Leader if they so choose to be.” (ConocoPhillips, 2009).

Attempting to shed light on which level of management may be more important as safety leaders, Flin (2009, p. 4) reports that in a survey of 200 power generation managers, when asked the question: “Which one of these management levels would you focus your attention on to the achieve maximum safety impact?” participants responded as follows:

1. Senior Managers: 42%
2. Site Managers: 11%
3. Supervisors / Team Leaders: 47%

Flin and Yule (2004) conducted a selective review of the industrial safety literature to identify safety leadership research with potential applications for healthcare, an industry that had previously been neglected in this regard. Their results indicated that a variety of leadership styles may be applicable across different situations, and that different leadership behaviours might be applicable at different levels within

organisations. They go on to discuss the characteristics of two well-established leadership styles - Transactional and Transformational - and their applicability to the healthcare setting.

Transactional leadership refers to behaviours that we commonly see from managers in everyday work settings. Leadership is seen as a transaction between leaders and followers, where some form of agreed exchange takes place. For example a manager offers workers a number of incentives and / or penalties that are contingent upon the worker meeting certain performance standards (e.g., attending work on time, wearing required personal protective equipment, correct uniform, etc.). Most leaders use transactional leadership with staff on a day-to-day basis and it is primarily focussed on appealing to individual goals and aspirations (Flin & Yule, 2004).

Transformational leadership is less commonly observed, and refers to the ability of a leader to inspire and motivate their followers. Transformational leadership theory developed from earlier work on charisma in politicians, extended to others in positions of influence. The theory posits that their actions have the effect of instilling a sense of purpose in followers, motivating them to set aside personal goals and adopt those of the organisation or assigned task. Transformational leadership is seen as augmenting the everyday achievements of transactional leadership. Transformational leaders employ charisma to engage workers, articulating a clear vision and mission, while treating individuals on their merits and encouraging free thinking, personal growth and responsibility. Bass and Avolio (1994; cited by Flin & Yule, 2004) present evidence to support the link between transformational leadership and worker performance, satisfaction and commitment.

Flin and Yule (2004) reviewed the safety literature in industries such as energy and manufacturing to determine whether insights about leadership behaviour in these industries could be applied to improve safety performance in healthcare. Their analysis identified specific Transactional and Transformational leadership behaviours that were found in empirical studies to be relevant at three management levels - senior managers, middle managers and supervisors (Table 2).

Table 2
Leadership Behaviours for Safety
(Adapted from Flin & Yule, 2004)

	Transactional behaviours	Transformational behaviours
Supervisors	Monitoring and reinforcing workers' safe behaviours. Participating in workforce safety activities (can also be transformational).	Being supportive of safety initiatives. Encouraging employee involvement in safety initiatives.
Middle managers	Becoming involved in safety initiatives (can also be transformational).	Emphasizing safety over productivity. Adopting a decentralised style. Relaying the corporate vision for safety to supervisors.
Senior managers	Ensuring compliance with regulatory requirements. Providing resources for a comprehensive safety programme.	Demonstrating visible and consistent commitment to safety. Showing concern for people. Encouraging participatory styles in middle managers and supervisors. Giving time for safety.

NB: These behaviours were drawn from the empirical research reviewed in this paper and classified according to transactional / transformational leadership theory.

Flin and Yule (2004) found emerging support for the conclusion that transformational leadership behaviour at all levels of management could influence safety performance, whereas the transactional style was effective mainly at the supervisory level. Middle managers were found to have a dual role to support communication about safety while ensuring compliance. In contrast, the greatest potential impact of senior managers was through their influence on safety culture.

These authors also cite a study on safety motivation by Andriessen (1978), showing that while supervisors are a decisive influence on the safety behaviour of the workforce, it is management that set the supervisor's goals, objectives, and priorities. Thus, senior management may have a greater degree of influence on workers' safety behaviour than supervisors. Andriessen argues that even if direct supervisors do not place a high priority on safety, workers may still work safely when this is stressed as important by higher management.

The International Civil Aviation Organisation (ICAO), the civil aviation industry's equivalent to the IAEA, has had a prominent role in advancing safety management in recent years through the implementation of safety management systems (SMS) across all elements of the global aviation industry. The latest iteration of ICAO's Safety Management Manual (International Civil Aviation Organisation, 2009) addresses the important role of safety leadership at a State (national) level within the global aviation community. It concludes that safety management guidance provided by the recommended State Safety Programme is "essential in generating confidence in the State's ability to provide safety leadership in an increasingly complex and constantly changing air transportation system. A central activity under this component is the development of a State safety policy" (2009, p. 221).

Leadership and Safety Performance

Reid et al (2008) note that while there is a small body of research devoted to the influence of top-level managers and their leadership style on organisational performance, most of these studies refer to impact on factors such as productivity, financial performance and innovation. There are few studies focusing explicitly on the link between the leadership style of top management and influence on safety performance. This is curious given the previously observed anecdotal link between senior management performance and large-scale industrial accidents.

As observed recently by Eid and his colleagues, "a number of studies have pointed out that leadership behaviour is a critical factor closely linked to the safety climate in organizations" (Eid et al, 2012, p. 55). They cite, for example, Hofmann and Morgeson's 1999 study that found the quality of exchanges between leaders and employees and perceived organisational support influenced accidents and that this relationship was mediated by self-reported safety communication and supervisor ratings of safety commitment. Eid et al conclude: "these results suggest that individuals are increasingly likely to be committed to safety and to engage in open communication regarding safety when they perceive the organization to be supportive and they have high-quality relationships with their leaders" (2012, p. 55).

Indeed, Hofmann & Morgeson concluded from their research that the level of safety commitment attributed to management can predict safety performance:

> It appears that the support (that) organizations show for their employees and the quality of exchange relationships with supervisors are associated with safety-related communication. This safety related communication is significantly related to safety commitment, which ultimately is predictive of accidents (1999, p. 294).

In a social system theory study linking safety leadership, safety climate and safety behaviour, Wu, Chen and Li (2008, cited by Patankar et al, 2012, p. 4) identified two paths that influence safety performance: one from safety leadership to safety climate and then leading on to safety behaviour; the other leading from safety climate directly to safety behaviour. They suggest that the finding that safety leadership has a direct influence on safety climate indicates that the best way for leaders to influence safety performance is to develop strategies to improve safety climate.

In a study focussing on military safety leadership, Zohar and Luria (2004) present a model indicating that supervisory safety practices predict the level and strength of safety climate, as moderated by leadership quality. Their study showed that injury results among soldiers were mediated by safety climate, which in turn was influenced by the clarity and style of leadership provided.

Authentic leadership is regarded as an emerging concept in the leadership literature and was chosen by Eid et al (2012) as the most fruitful model for the basis of their quest to identify human mechanisms that affect safety outcomes. They observe that according to the theory of authentic leadership, "leader self-awareness and self-regulation processes are vital mechanisms in the leader-follower exchange" (p. 55).

They describe authentic leadership as "a pattern of leader behaviour that draws upon and promotes both positive psychological capacities and a positive ethical climate". Authentic leaders "tend to foster greater self-awareness, relational transparency, an internalized moral perspective, and balanced processing in the sense of comprehensive information search and processing, resulting in positive self-development in followers" (Eid et al, 2012, p. 58).

Authentic leaders are seen to enhance "the engagement, motivation, commitment and involvement required from followers to constantly improve their work and performance outcomes through processes of personal and social identification, resulting in improved job satisfaction and performance in followers." (Eid et al, 2012, p. 57). Being 'authentic' involves both owning one's personal experiences and biases (values, thoughts, emotions and beliefs), and acting in accordance with one's true self (expressing what you really think and believe and behaving accordingly).

Eid and his colleagues conclude that authentic leadership directly affects safety outcomes in safety critical organisations via the promotion of positive safety climate perceptions, values, attitudes and behaviours.

In a recent review of three decades of research on safety climate, Zohar (2010, cited by Eid et al, 2012, p. 56) concludes that "the relationship between safety climate and safety outcomes are well established in the literature, and that there is now a growing need to develop a better theoretical understanding of antecedents, mediators and moderators of this relationship."

3. Safety Leadership in Safety Critical Industries

This section reviews research on Safety Leadership in eight safety critical industries: nuclear power generation, commercial aviation, air traffic management, offshore oil and gas production, the maritime industry, healthcare, resource mining and rail transport. This is by no means a complete list of industries or other complex socio-technical activities (such as military operations) where leadership behaviour influences safety. These industries have been selected because they: (a) face similar challenges to the nuclear power industry (although not necessarily the same hazards and risks); (b) have recognised that safety leadership is important; and (c) have contributed worthwhile research or practice on this topic.

Nuclear Power Production

The concept of safety leadership now features consistently in the nuclear safety literature, where leadership and management constructs are frequently linked to safety performance. Leadership is often discussed in relation to a fundamental element of safety culture – the commitment of an organisation's senior managers to safety (e.g. Lowe & Hayward, 2006; Institute of Nuclear Power Operations, 2004; International Atomic Energy Agency, 2002a; Collins, 2006). This focus originated soon after the Chernobyl disaster in 1986, when the "management, organization and attitudes of the personnel" were identified as influential to safety, "for better or worse" and the contribution of management to creating and sustaining a safety culture was emphasised (Reiman & Oedewald, 2009, p. 17).

A 1991 report by the International Nuclear Safety Advisory Group (INSAG) of the IAEA (International Nuclear Safety Advisory Group, 1991) is an early example of research recognising the importance of management commitment as a key component of safety culture. This review distinguishes two key components of safety culture: "the framework determined by organizational policy and by managerial action", and the response of individuals working within that framework (p.2). The INSAG report identified *commitment*, in terms of senior management demonstrating the high priority given to safety, and *supervision*, in terms of appropriate audit and review processes, as universal features of safety culture. In a more recent example, the Institute of Nuclear Power Operations (INPO, 2004) identified safety leadership as an essential attribute for a healthy safety culture, emphasising the importance of executives and all senior managers demonstrating their commitment to safety in both their communications and their actions. INPO highlights attributes such as leaders practicing visible safety leadership, correcting deviations promptly, providing appropriate oversight and clearly and unambiguously communicating the importance of safety goals as important for a strong safety culture.

Several research studies have been undertaken specifically to examine the link between leadership and safety in the nuclear industry. For instance, a study of nuclear power plant workers in Finland by Kivimaki, Kalimo and Salminen (1995) found a significant influence between workers' trust in top management (defined as trust in the extent to which they prioritise safety over production) and acceptance of organisational goals by workers and perceived nuclear risks. A study of several nuclear plants by Lee (1998, cited by Health & Safety Executive, 2005) similarly identified an association between a strong commitment to safety by senior management and low accident risks. Particular management styles, such as a

'democratic, humanistic style, a style involving increased communication, feedback and time spent at the worksite, and a style involving a high level of one-to-one interaction with employees, have also been found to be associated with improved safety (see Lee, 1998; Kivimaki, Kalimo & Salminen, 1995; Smith, Cohen, Cohen & Cleveland, 1978, cited by Flin & Yule, 2004).

Safety culture evaluation work, including elements of safety leadership, is reasonably advanced in the nuclear industry. For instance, the former Swedish nuclear regulator SKI commissioned a *safety culture enhancement* study to derive insight into management perceptions and influences towards safety, to provide feedback to senior management and suggest improvements, and to develop for the regulator a broad perspective on future requirements and safety culture enhancement opportunities (Lowe & Hayward, 2006). This approach was based on the recognition that senior management have a significant impact on safety culture at nuclear sites.

Considerable guidance on safety culture enhancement with reference to management commitment and leadership is available. For instance, considering the development of safety culture, the IAEA (International Atomic Energy Agency, 1998) suggests that senior managers should emphasise their commitment to safety through activities such as being visibly interested in safety, identifying safety as a priority in meetings and strategic plans, encouraging employees to discuss safety issues, and demonstrating a genuine interest in safety improvements. Further guidance is available on specific questions to consider when evaluating management commitment to safety in the nuclear industry, on good design principles for safety culture questionnaires, and a range of other important issues (e.g., International Nuclear Safety Advisory Group, 2002; International Atomic Energy Agency, 2002a). The Institute of Nuclear Power Operations (2004) identifies a similar list of attributes that managers and supervisors can display to set an example for workers in regard to safety.

Finally, the aforementioned safety culture enhancement research conducted for SKI (see Lowe & Hayward, 2006; Axelsson, Hayward & Lowe, 2007; Lowe et al, 2008) provided a list of specific safety leadership competencies for managers in the nuclear power industry to assist in safety culture development.

Commercial Aviation

In the aviation industry, discussion of safety leadership tends to emerge as part of broader discussions on safety culture and error reduction. It is widely recognised in the aviation context that effective safety leadership at the management level plays an important role with respect to safety outcomes and the development of an appropriate safety culture. For instance, Hudson (2003) has discussed the critical importance of managers knowing what is going on within their organisations, of responding appropriately to reported errors and near misses, and of reinforcing a culture of flexibility, learning and trust. Van Dyke (2006), points out that management commitment may be regarded as "The single most important determinant of airline safety" (citing FSF, 1989), and "The most important factor differentiating organizations with differing levels of safety" (Diaz & Cabrera, 1997).

Beyond the safety culture context, safety leadership has also been considered as part of a human factors-based approach to error reduction in aviation. For instance, Anfield (2007) highlights the importance for error-reduction of leaders developing and modelling a culture of trust, of establishing openness and of responding promptly to reported hazards. He also draws attention to the value of managers' understanding about error factors in their organisations. He quotes an assessment by the Australian Defence Force's Aviation Maintenance Improvement Project

(Australian Defence Force, 2005) that revealed that the further away successive levels of management are from the maintenance hangar floor, the less the respective managers will know about real error rates. For instance, while 75% of first line supervisors were found to be aware of errors, only 6% of managers and 4% of senior managers showed similar awareness, despite the fact that decisions tend to be made at these higher levels.

Evaluations of safety leadership in aviation organisations appear only to have been conducted as part of broader safety culture assessments. For instance, Baines Simmons-Americas used their Safety Culture Organizational Review Evaluation (SCORE) assessment tool to survey aviation maintenance technicians and management groups in 2007 and 2010 to assess several aspects of safety culture, including management and leadership dimensions. Smith's (2010) review of the findings highlighted several areas of concern relating to managers being perceived by workers as knowingly condoning noncompliant behaviour and procedural shortcuts to speed up work on aircraft, and investigating incidents to 'blame and punish' rather than to understand systemic weaknesses. As Smith observes, these perceived management attitudes are unlikely to foster an atmosphere of procedural compliance and openness about errors, violations and workplace risks.

Efforts to formally develop safety leadership in aviation organisations have tended to focus on the local team level, such as training airline pilots in leadership skills, rather than on higher levels of aviation management. The critical importance of the captain's leadership role in dealing with safety events has been discussed widely in the context of Crew Resource Management (CRM) training in aviation. Many CRM courses include sections on team management, supervision and leadership, focussing on skills such as effective delegation, task prioritisation, coordinating good briefings, using the available time to develop the team, assertive communication, and establishing appropriate authority gradients within the cockpit team (Hackman, 1993; Ginnett, 2003; Flin, O'Connor & Crichton, 2008).

Similarly, methods for evaluating and assessing leadership skills have tended to focus on the team leader level. For instance, the NOTECHS behavioural marker framework for pilots includes categories relevant to leadership skills, such as assessments of use of authority and assertiveness, maintaining standards, clearly stating intentions and goals, and allocating workload efficiently (Flin et al, 2008).

Air Traffic Management

Safety leadership in Air Traffic Management (ATM) is most often discussed as part of the broader topic of safety culture, as occurs in the wider context of commercial and military aviation discussed above. The relevant literature in ATM reflects that positive safety leadership is regarded as an essential component of a strong safety culture. A White Paper on *Safety Culture in Air Traffic Management* by the European Organisation for the Safety of Air Navigation (EUROCONTROL, 2008) suggests that "A strong Safety Culture begins with leadership commitment to making safety a priority in every decision" and that if people working within an organisation believe that safety is *not* the priority of the day, their actions and decisions will be influenced, allowing unsafe conditions and ultimately accidents to occur (p 12). The EUROCONTROL White Paper goes on to suggest that, while the availability of competent, safety-committed managers is linked to a strong safety culture, a positive safety culture spreads most easily and effectively throughout an organisation if it exists at higher levels of the organisation. As such, a variety of practical steps that can be taken at the Board and CEO level to promote a strong safety culture have been identified (EUROCONTROL, 2008). These include, for

example, the CEO and senior management asking questions about safety, and showing an interest in tangible safety issues; the CEO chairing the organisation's Safety Committee and seeking to understand safety risks and how they are being addressed; distributing information on the key safety risks and mitigation strategies to the entire organisation; supporting a Just Culture; allocating funds to safety efforts; and visiting the operational centres and workplaces to discuss safety with workers.

Specific, practical guidance on developing, measuring and improving safety culture is provided in EUROCONTROL's (2009) comprehensive on-line *Safety Culture Enhancement Toolbox*. Several components of this guidance material focus specifically on safety leadership and the importance of management commitment to safety. For instance, a set of 'management safety competencies' is provided to guide managers on behaviours to demonstrate commitment to safety. These include encouraging workers to report hazards, safety concerns and 'normal errors'; showing 'visibility' in the workplace; and correcting unsafe behaviours of others to maintain safety standards, for instance. The guidance also suggests that, because of the key role that all levels of management play in regard to safety, senior managers and supervisors require specialist training. Details on education for senior managers and safety culture competencies for supervisors are outlined in the Safety Culture Enhancement Toolbox.

Specific research into the 'safety intelligence' of European ATM managers, in terms of identifying traits and skills related to safety outcomes, is also underway as a PhD project, funded by EUROCONTROL and due for completion in late 2012 (Fruhen, in preparation).

Oil and Gas Production

The topic of safety leadership has become a significant research focus in the oil and gas production industry. Interest in the topic was in part prompted by accidents such as the Piper Alpha oil rig disaster and the Esso Longford gas plant explosion, in which deficiencies were highlighted at the management level of the organisations involved (Cullen, 1990; Hopkins, 2000). As in the industries previously discussed, the importance of leadership has also been recognised as a critical component of safety culture. For example, the UK Health and Safety Executive (HSE, 1999) identified a number of organisational factors specifically involving management behaviour that were associated with safety culture: Senior management commitment; management style; visible management; good communication between all levels of employee; and a balance of health and safety and production goals.

Professor Rhona Flin of the University of Aberdeen was one of the first industry experts to recognise that the topic of safety leadership warranted study in its own right, stating that "it is not difficult to discern an emerging theme – managers, especially senior management are key influences on the safety culture" (Flin, 2001).

Studies on the interaction between management behaviour and employee perceptions, as contributors to safety culture, have been undertaken in a number of countries involved in offshore oil and gas production. O'Dea and Flin (2001) report several studies of off-shore petroleum installations that confirm the importance of management behaviour in regard to safety. For instance, Rundmo's 1994 study of the Norwegian offshore environment found that employee perceptions regarding management commitment to safety and the priority given to safety over production pressures, were strongly linked to their satisfaction with safety and contingency measures in their work environments (cited in O'Dea & Flin, 2001).

Research in the North Sea by Flin and Mearns (1994) similarly indicated that management commitment had a strong effect on worker's perceptions of risks in their operating environment, and their satisfaction with how safety issues were addressed (cited in Cox & Cheyne, 2000). In their paper on *Safety Leadership in the Offshore Oil and Gas Industry*, O'Dea and Flin (2000) note that in addition to a general management commitment to safety, participative management (in which managers become involved in work and safety activities and have frequent, open communications with workers), encouragement of the workforce to become involved in safety activities, and empowering workers to be actively involved in the development of safety initiatives and policies, are all associated with improved operational safety performance. Safety leadership, in terms of management commitment to safety, has been incorporated into several safety culture assessments undertaken in this industry (Cox & Cheyne, 2000).

Efforts to *improve* safety leadership, for example through dedicated training initiatives, have followed logically from the recognition that management can directly influence safety performance, for better or worse. Some of these efforts have focused on adaptations of airline-style Crew Resource Management (CRM) and human factors training for the industry. For instance, CRM training has been delivered to offshore installation managers and teams as part of emergency response team training (Mearns, Whitaker & Flin, 2003). This training was designed around topics that have proven valuable in leadership and command training in other industries, including definition of team roles, assertiveness, team attitudes and group decision-making.

Another CRM-style training course for offshore platform crew incorporated a supervision and leadership category focusing on use of authority and assertiveness, maintaining standards, planning and co-ordinating tasks, and workload management. Responses to this training derived from course feedback questionnaires were reported as generally positive (Mearns et al, 2003).

Training designed to specifically improve safety leadership has also been developed and implemented in this field. Guidance documentation on implementing behavioural change in the oil and gas industry (Step Change, 2000) suggests that interventions relating to safety leadership need to vary depending on a site's level of safety maturity. The authors of this guidance document suggest that, for sites with lower levels of safety maturity, efforts should be directed at addressing issues of trust in management and their perceived commitment to safety, and leaders should receive knowledge-based training on how to behave safely and motivate subordinates to do the same. Sites with a higher level of safety culture maturity can use skills-based leadership training for supervisors, and also train staff in monitoring their own behaviour and that of others. At the highest levels of safety culture maturity, interventions should focus on upward appraisal of managers and long-term leadership development needs (Step Change, 2000). A specific safety leadership training syllabus has been developed to assist in these processes, and is applicable to personnel in leadership roles at all levels of an organisation. The guidance documentation recommends that training programs are most effective if participants are given feedback on their current performance and an opportunity to develop the relevant skills for involving their staff in safety and demonstrating commitment. Purely knowledge-based courses are less likely to be effective, and ongoing training and support are recommended for ensuring sustained improvement (Step Change, 2000).

Safety leadership evaluations at the individual level have also been carried out. Step Change (2000) reports that several companies have conducted feedback activities for

senior managers, to investigate how subordinates perceive their commitment to safety. This feedback, sometimes indicating that senior management are not perceived as placing safety as the highest priority, enables managers to review their behaviours regarding safety to give clearer and non-conflicting messages about the priority given to safety.

In an attempt to share best practice and learning between different sites, a "Step Change in Safety Leadership Day" was held in Aberdeen in 2011, attended by senior figures from across the oil and gas industry. The aim was to provide an opportunity for leaders to discuss plans and achievements in demonstrating commitment to safety and showing 'visible leadership', and to collaborate on learning.

Maritime Industry

Safety leadership and the role of management in creating safe operations is an emerging topic of interest in the maritime industry. Leadership issues tend to be discussed in the context of safety culture and safety climate surveys, such as those conducted by Håvold (2005, 2007) to review Norwegian shipping companies. Håvold's measurement scale incorporated several aspects relevant to leadership, including management / employee commitment to safety, fatalism, degree of conflict between safety and work priorities, reporting culture, and safety communication (cited in Hetherington, Flin & Mearns, 2006). Similarly, safety culture assessments made by Ek, Olsson, and Akselsson (2000) encompass a variety of dimensions linked indirectly to safety leadership, such as reporting culture, flexible culture, just culture and learning culture (cited in Hetherington et al, 2006), highlighting the relevance of safety leadership to safety culture.

Beyond the safety culture context, Flin et al (2008) have noted that failures in leadership and crew coordination are frequently implicated in shipping accidents. Similarly, the UK Maritime and Coastguard Agency (MCA) has recognised that the safety of maritime operations at sea, on-shore and at the shore-ship interface, depend greatly on the leadership skills and attitudes of senior officers. Following from these findings, the MCA commissioned research work to identify the "barriers and enablers for effective safety leadership in the industry" and to develop practical guidance for leaders to improve their safety performance (Little, 2004).

This research identified strengths in regard to safety leadership in areas such as:

- commitment to safety, which was reported as generally high;
- the International Safety Management Code, which provides an international standard for safe shipping management and operation and influences safety management positively;
- improvements in communication methods in support of good leadership; and
- clear command structures, in which the Master is well-regarded as the safety leader (Little, 2004).

The MCA study identified a number of barriers to effective safety leadership. These included command and authority issues between the ship and shore, widespread employment of multinational crews, which creates leadership challenges, and an emphasis in training on technical skills rather than leadership (Little, 2004).

The practical guidance developed as part of this research incorporated a list of ten core safety leadership qualities for leaders and senior officers in the maritime industry to use to improve their safety skills. These have been compiled in a brief,

practical guidance document (Maritime and Coastguard Agency, undated), which discusses each leadership quality, explains why these are important, and identifies briefly how leaders can achieve or demonstrate the qualities (see Section 4.2 for further detail on the core qualities).

Leadership training often features as a specific topic in Crew Resource Management-style training courses developed for use in the maritime industry. Early work in this area began in the 1970s with the development of Bridge Operations and Teamwork simulator-based training for masters and officers of large oil companies (Haberley, Barnett, Gatfield, Musselwhite & McNeil, 2001). Later developments in this form of training led to the implementation of various Bridge Team Management, Bridge Resource Management, Engine Room Resource Management and Maritime Resource Management training programs (Barnett Gatfield & Pekcan, 2004; Hayward & Lowe, 2010; Hetherington et al, 2006), all of which typically include some leadership development components.

Health Care

The term 'safety leadership' is becoming increasingly prominent in health care literature, and there is a widespread understanding of the importance of effective leadership in this industry. Much of this recognition has evolved from research in other domains, such as the offshore oil industry and aviation. Flin and Yule (2004) highlight a problem with extrapolating from other industries in this context, which is that the leadership structure of health care organisations tends not to match those of other organisations. In particular, they note that formal leadership is not as well defined in health care as it is in other industries, specifically because:

- recognition of who is 'in charge' is problematic;
- several individuals may believe they hold the leadership position in a given team;
- the main leadership role may shift to different people at different times; and
- individuals of a higher rank (such as chief executives) may in fact hold less power than influential subordinate staff.

They suggest that relatively little research has been carried out regarding leadership and safety in heath care itself, as attention tends to be focused on activities of frontline staff, but that relevant studies do support the findings from other industries that safety leadership behaviours at all levels of management are important for safety performance (Flin & Yule, 2004).

For instance, specific research findings have indicated that hospitals experienced fewer errors when safety was a high priority for management; that improved rates of clinical governance and reduced rates of patient complaints were linked to hospital staff perceptions of senior management leadership; and that the willingness of surgical team members to 'speak up' was influenced by the team leader's behaviour (Katz-Navon et al, 2005, Shipton et al, 2008, and Edmondson, 2003, cited in Flin et al, 2009). Other studies revealed that "engaged senior managers was a key feature for improving complex clinical processes" and that the success of clinical innovations was dependent on support and recognition by leaders, as well as organisational support and appropriate implementation tools. Leadership support was defined as entailing "prioritizing and talking about the innovation and reviewing progress toward its accomplishment" (Singer & Tucker, 2005).

Despite the limited research on this topic, there does appear to be a good understanding in this domain of the link between high-level safety leadership and safety outcomes. For instance, Botwinick et al (2006, quoted in Flin et al 2009), suggest that "Only senior leaders can productively direct efforts in their healthcare organisations to foster the culture and commitment required to address the underlying systems causes of medical errors and harm to patients". Similarly, Frankel et al (2003, p. 17) note that a key characteristic of teams that perform consistently well in the healthcare context is "the support of a champion in a high administrative position" and that "Leadership support is a necessity to enable change to occur". A report published by the UK Health and Safety Executive on reducing error (Health and Safety Executive, 1999, p. 18) states that organisational culture and management behaviour impact on safety violations and rule-breaking, and that managers and supervisors therefore "need to send positive messages about health and safety".

In terms of evaluating safety leadership in health care, the results of a large number of safety culture or safety climate surveys are available. Flin et al (2006) studied 12 safety culture / climate assessments in healthcare and identified that management commitment to safety was the most frequently measured dimension in these studies.

Another recent study measuring perceptions of safety climate in primary health care highlighted a trend of some concern, apparently common to other industries, of individuals in the management group perceiving the safety climate to be "significantly more positive than those in the 'employee' group" (de Wet, Johnson, Mash, McConnachie & Bowie, 2010, p. 139). Other evaluations have focused on leadership independently of safety culture. For instance, one approach involves 'upward appraisals', in which leaders are rated in terms of their leadership skills by themselves, and also by their subordinates to gather feedback on their perceived commitment to safety (Flin et al, 2009).

Some of the guidance on improving safety leadership arises in the context of improving safety culture in general. For instance, a section of the HSE guidance document on developing a good safety culture (Health and Safety Executive, 1999, p. 40) identifies several key organisational factors relevant to safety leadership, and how these can be improved. The factors include *senior management commitment*, which is regarded as "crucial to a positive health and safety culture". The HSE document suggests that this is best demonstrated through the allocation of resources (time, money, staff) to safety, the status given to safety, and the active involvement of management in safety issues. Another is *visible management*, in which managers are actively and visibly involved in health and safety on the 'shop floor'. This helps staff to see and believe that management are committed to safety. *Good communication* within and between all levels of the organisation is another key factor, facilitated by encouragement of health and safety discussions and an 'open door policy' to enable direct communications with senior management. Finally an appropriate *balance of health and safety against production goals* in which "safety is regarded as important, is promoted, and is not compromised", helps to create an atmosphere where shortcuts and violations are discouraged and safety is viewed as paramount.

The proposed approach to improving safety culture is to review the existing safety climate, determine those areas of highest priority for change, identifying a means of change and implementing the actions, and reviewing the outcomes before repeating the process (Health and Safety Executive, 1999).

In their discussion paper on *Creating a Culture of Safety in Hospitals*, Singer and Tucker (2005) identify six actions required for strong safety leadership, derived from a field study of eight hospitals. The recommended actions involve: communicating a clear, compelling safety vision; valuing contributions to safety and empowering personnel to contribute to safety improvement efforts; being actively engaged in improving patient safety; leading by example; focusing on systems issues, and adopting a just approach to errors; and continually searching for opportunities to improve.

Other suggestions for effective leadership in health care (Flin et al, 2009; Health and Safety Executive, 1999; National Patient Safety Agency, 2004; Singer & Tucker, 2005) include:

- actively listening
- explaining to staff the relevance and benefits of patient safety
- promoting a climate of respect and openness for people to speak up
- monitoring and reinforcing workers' safety behaviours
- emphasising the priority of safety over productivity
- playing an active part in safety initiatives
- encouraging employees to be involved and take ownership of safety initiatives
- visibly receiving and acting on health and safety performance reports
- ensuring safety recommendations are implemented
- ensuring that appropriate safety actions are taken swiftly and that staff are aware that these actions have been taken
- promoting safety reporting
- learning from experiences and sharing safety lessons.

In regard to appropriate behaviours for leaders, however, Flin and Yule (2004) make the important observation that different leadership behaviour is required at different levels. They suggest that effective leadership behaviours at the supervisory level include setting goals and gaining compliance, with attention to monitoring and reinforcing positive behaviours. For middle managers, the focus should be on ensuring compliance while also being involved in safety and opening communication channels. At the senior management level, a visible commitment to safety and dedication to safety matters must be demonstrated consistently, as senior managers have the greatest potential to influence organisational outcomes (Flin & Yule, 2004).

A safety leadership development technique proposed by Frankel et al (2003) involves the conduct of "Executive WalkRounds™", in which senior managers visit different sections of the hospital to discuss safety issues and 'near misses' with staff. This approach, similar to the concept of *visible management* described above, has the joint benefits of enabling managers to gain an understanding of safety issues, which can then be acted on, as well as demonstrating their interest in, and commitment to, safety to frontline staff. Leadership, and related topics such as use of authority, teamwork, communication and decision making, are also incorporated in versions of Crew Resource Management training adapted to health care, such as Anaesthesia Crisis Resource Management (ACRM; Howard, Gaba, Fish, Yang & Sarnquist, 1992), Team Resource Management, and Operating Room Crisis Training (see Hayward & Lowe, 2010 for further discussion of these training programs).

Resource Mining

The global resource mining industry appears to lag behind other domains in regard to published research studies on safety culture and safety leadership. This does not indicate however that leadership is not considered an important influence on safety in this industry. For instance, BHP Billiton (undated), one of the world's largest resource mining companies, highlights leadership issues in their "Behavioural Intervention Process" for achieving zero harm in safety. One stage of their process includes conducting a safety attitudes survey that takes into account management support and the priority given to safety over production. Another stage involves "leadership workshops", which educate managers in support behaviours for supervisors and strategic behaviours for managers, and include measurement of leadership behaviours via observation and the use of 360-degree feedback processes.

The New South Wales (NSW) Minerals Council in Australia also identifies safety leadership as a key issue with regard to Occupational Health and Safety. A Safety Leadership workshop held at an industry conference in 2005 confirmed the view that effective safety leadership is necessary for improving safety outcomes, and that everyone in the industry has a leadership role to some degree. It was noted however that there were challenges to be faced, particularly with regard to perceived conflicts between production and safety, but that there were also practical strategies for addressing these challenges (NSW Minerals Council, 2005).

On the basis of the workshop outcomes, they provide specific guidance on improving safety leadership, tailored to the different worker groups (NSW Minerals Council, 2005). The guidance for *managers* is similar to that suggested in other industries, including activities such as developing a clear safety vision and inspiring people towards it; creating employee engagement; involving employees in safety activities and decisions; balancing safety and production goals; communicating safety plans, outcomes, and expectations; allocating resources to safety activities; and being open to feedback and willing to act.

Team leaders are encouraged to 'walk the talk'; act in accordance with stated safety commitments; support a zero tolerance approach to shortcuts and unsafe acts; monitor performance of team members to ensure they meet safety plans and objectives; visibly and genuinely model positive safety behaviours at all times; welcome communication and feedback from others; and provide support and feedback to improve team safety, among other activities.

Guidance is also provided on *self leadership*, under the view that every worker is responsible for acting in accordance with the safety values and procedures of the company. The guidance for workers includes: challenging themselves to "make a difference in safety"; using the safety systems, processes and plans appropriately; recognising hazards and asking for help when needed; and intervening appropriately to reinforce safe behaviour.

The overall process for improving safety leadership at the organisational level involves several steps, including:

- agreeing on the organisation's position in regard to safety ("the Vision"), gaining commitment from workers and defining specific expectations;
- assessing the 'gap' between "the Vision" and the current situation, determining the areas where improvement is required and considering how the 'gap' will be closed;

- agreeing on what needs to be done, the process that will be followed, key people, roles and responsibilities for initiating the changes, and the group and individual targets to be met; and
- providing efficient resources for implementing the changes, determining the systems and skills for implementation and, after implementation, monitoring progress and assessing the value of the change process to organisational goals (NSW Minerals Council, 2005).

Other, more informal guidance on improving safety leadership in the resource mining sector is also available online. For instance, the website *miningman.com* includes a 'leadership' section that provides advice on topics such as how to give positive and negative feedback to team members, tips for leading a team that you used to be a part of, and mistakes that leaders make with regard to safety. Mistakes include, for instance, not "walking the talk", or not demonstrating that safety is the leader's top priority; ignoring or failing to address safety breaches or unsafe acts; failing to provide positive feedback; and not visibly supporting the organisation's safety systems (Ross, undated). Some dedicated safety leadership training programs are also available for mining industry executives (e.g., the 'Masterclass in Safety Leadership for Industry Leaders', run by the Mineral Industry Safety and Health Care Sustainable Minerals Institute at the University of Queensland).

Rail Industry

One of the earliest references to the term 'safety leadership' in the rail industry was made in the Part 2 Report of the Ladbroke Grove Rail Inquiry published in 2001 (Cullen, 2001). This was the second of two reports by Lord Cullen into the 1999 Ladbroke Grove train accident at Paddington in the UK, in which 31 people died and more than 520 were injured. Just as the Chernobyl accident had stimulated concern to understand the influence of culture on safety in the nuclear power industry, Lord Cullen's investigation into the Ladbroke Grove accident led to significant change in the British rail industry, including an increased focus on safety management and cultural change. Recommendation 55(vi) of the Part 2 Report proposed that a new rail safety body be created (subsequently becoming the current Rail Safety Standards Board, RSSB), in part to provide 'safety leadership' for the industry.

In response to these recommendations, a program of work was subsequently initiated in the UK by Her Majesty's Rail Inspectorate (HMRI; 2004) to improve rail safety. Five elements of safety culture, paralleling issues identified in the Ladbroke Grove Inquiry, were nominated for attention: *Leadership*, *Two-way communication*, *Employee involvement*, *Learning culture*, and *Attitude towards blame*.

In 2005 the UK Health and Safety Executive (HSE) undertook a project to review the literature on safety culture and to 'develop and validate a [safety culture inspection] toolkit for use by HMRI, to assist in the validation of the safety culture recommendations' resulting from Ladbroke Grove (2005, p. 1).

In regard to the 'safety culture indicator' of Leadership, the HSE review observed that "Existing research is clear that leadership must be one of the first priorities for the establishment of a positive safety culture" and that "the key message outlined by the report is the importance of a strong management commitment to safety and to demonstrate this dedication to employees at all levels, as well as to the public." (2005, p. 8). The HSE review also refers to an important distinction made in the Ladbroke Grove accident report (Cullen, 2001) between 'safety leadership across the industry', and 'safety leadership within individual companies'.

The HSE review further dissected the concept of safety leadership, citing previous research that considered three key leadership criteria (Health and Safety Executive, 2005, p. 10):

- Safety versus Performance Priority ~ the requirement that 'Senior management should give safety a high status within the organisation's business objectives, and safety should be prioritised in all situations'.
- High Visibility of Management's Commitment to Safety ~ defined as senior managers being able to 'demonstrate visibly and repeatedly their commitment to safety throughout all areas of the organisation', and
- Safety Management System, a requirement that 'organisations should have effective systems in place for the management and co-ordination of safety', and that this should be led by a 'strategic safety leadership team'.

In the rail industry globally, the focus on safety leadership has not been as evident as it has in the UK, where a number of serious rail accidents demanded top-driven cultural change. For example, the International Rail Safety Conference (IRSC) has been held annually since 2002, with most presented papers made available online. A review of the presentations listed reveals that prior to 2010, only two papers contained either of the terms *safety culture* or *leadership* in their title. One of these was a review of safety culture in the Swedish railway industry (Ring, 2004). Although not focused on leadership specifically, the paper noted the important role of top management in approving and supporting activities – sponsored by Management for Swedish National Rail Administration – designed to promulgate a set of core values, which included safety, throughout the rail industry.

The second IRSC paper addressing safety culture (Neil, 2004) reported a series of steps used to develop and maintain a safe culture through a period of major change when two freight rail operations were merged. Phase 1 was directed towards eliminating unsafe conditions. The aim of Phase 2 was to change employee behaviour, a process that required 'senior management to demonstrate commitment', and other leaders (supervisors) to understand how their actions influenced both positive and negative behaviour of their teams.

Two presentations at the 2011 International Rail Safety conference held in Melbourne, Australia were the first to address leadership and high level commitment to safety in any direct way. In his presentation, Hedley (2011) observed that:

> "Safety comes from those at the top of an organisation. It does not happen by accident (pun intended) and must be carefully planned if it is to happen. Experienced staff are much too smart to be fooled by platitudes from corporate leaders but will judge by their example. Safety commitment is not to be found in the Safety Policy either, but rather in all the non-safety specific procedures and behaviours which are often created without consideration of safety consequences. It is these which collectively conspire to defeat any latent safety enthusiasm." (paper abstract)

At the same IRSC 2011 conference, Boulger (2011) outlined three sets of tools used in a large construction company (involved in rail projects) to drive the desired safety leadership behaviour. These tools were applied at different career points, and covered: (a) the way leaders were brought in and promoted within the company; (b) techniques to maximise and raise the profile of safety leadership; and (c) ways to increase employee involvement, for example through annual safety workshops.

4. Safety Leadership Models

Much of the early research on safety culture and safety climate was directed towards identifying the dimensions underlying these concepts, and using questionnaires to measure the importance of these dimensions in organisational settings (see Yule, 2003 for a review, cited by Flin & Yule, 2004). Many of the dimensions investigated referred to the attitudes and behaviour of management, for their commitment, or supervisory and leadership style. These same dimensions are now the focus of more recent research on the specific topic of Safety Leadership (e.g., Flin, 2003, 2010; Flin & Yule, 2004; Dunlap, 2011).

This section summarises selected examples of safety leadership models developed in a range of high-risk industries. A liberal definition of the term 'model' has been applied, as some of the examples are presented as simple lists of safety leadership attributes or desired behaviours. These examples do not fit the definition of a properly constructed competency framework, nor are they written in accordance with accepted criteria for good behavioural markers, as specified for example by Klampfer, Flin, Helmreich et al (2001) in their guidance report on using behavioural markers in high risk industries. The content in the examples below could be readily adapted however to develop a more formal safety leadership competency framework. Similar models have already been developed in fact, and underpin the leadership evaluation and development processes described in Sections 5 and 6 of this review.

Nuclear Power Production

One of the earliest expositions of safety culture comes from the nuclear power industry and was published in 1991 by INSAG (International Nuclear Safety Advisory Group, 1991). This analysis of the 'universal features' of safety culture included the elements described in Table 3 below.

Table 3
INSAG: Features of Safety Culture

'Element'	Explanation
Individual awareness	… of the importance of safety.
Knowledge and competence	… conferred by training and instruction of personnel and by their self-education.
Commitment	… requiring demonstration at senior management level of the high priority of safety and adoption by individuals of the common goal of safety.
Motivation	… through leadership, the setting of objectives and systems of rewards and sanctions, and through individuals' self-generated attitudes.
Supervision	… including audit and review practices, with readiness to respond to individuals' questioning attitudes.
Responsibility	… through formal assignment and description of duties and their understanding by individuals.

While the elements in Table 3 are directed to 'organisations and individuals at all levels', there is a clear implication that industry managers have a pivotal role in contributing to a safety culture.

Over the following two decades, more detailed and specific descriptions of safety leadership have evolved within the nuclear industry. The dimensions and behaviours set out in Table 4 below are taken from a draft version of the IAEA's advisory document on safety culture assessments conducted at nuclear installations using the SCART (Safety Culture Assessments Review Team) process (International Atomic Energy Agency, 2007).

Table 4
Nuclear Power Industry
Management Competencies: Leadership for Safety

Safety Leadership Dimension ("Attributes")	Behaviours
[B1] Senior management is clearly committed to safety	• Senior managers should treat supervisors as a crucial part of the management team as they translate safety culture into practice, and should provide them with their full support; • Senior corporate leaders should periodically visit operating facilities to assess management effectiveness first hand.
[B2] Commitment to safety is evident at all management levels	• Leaders should establish clear expectations for performance in areas that affect safety and these should be documented where appropriate; • Leaders should adhere strictly to policies and procedures in their individual conduct, and should not expect or accept special treatment; • Leaders should not accept or ignore sub-standard safety performance for any reason; • Leaders should exhibit a strong sense of urgency to correct significant weaknesses or vulnerabilities.
[B3] There is visible leadership showing the involvement of management in safety related activities	• Leaders should be able to recognise degraded safety conditions (physical or organisational); • Leaders should individually inspect performance and conditions in the field by walking, observing and listening to individuals, and should intervene vigorously to fix safety problems (walk, look, listen and fix); • Managers should ensure situations adverse to safety are corrected; • Supervisors should spend time observing and coaching individuals at their work locations and should provide constructive feedback to reinforce expected behaviour; • Supervisors should frequently discuss safety issues with their teams/work groups; • Leaders should visit individuals at their work locations.

It is noteworthy that SCART is an IAEA safety review service, available to nuclear power production (NPP) operators from IAEA member states. The mere fact that the

SCART service is available, that SCART missions frequently occur, and that SCART guidelines documents exists demonstrates the importance now placed on safety culture and leadership by the IAEA and most elements of the global nuclear power production industry.

Table 5 shows elements of the safety leadership model developed during a safety culture enhancement project conducted for the former Swedish Nuclear Power Inspectorate, SKI (Lowe & Hayward, 2006; Lowe et al, 2008).

Table 5
Swedish Nuclear Power Industry Safety Leadership Model

Safety Leadership Dimension	Behaviours
Showing commitment	Demonstrates interest in safety activities/matters; Shows persistence in addressing safety issues and deficiencies; Displays enthusiasm regarding safety checks and activities
Promoting safety	Communicates about safety/delivers safety culture messages; Highlights past investments in safety; Promotes safety as a top priority
Clarifying safety goals	Explains organisational goals and vision regarding safety; Expresses clear expectations about safe behaviour; Sets and communicates clear safety goals
Being actively involved	Is systematically visible; Is seen around by staff, regularly interacts with people; Coaches and leads staff via dialogue
Setting an example	Follows safety rules, sets a positive example; Leads by example in acting safely; Ensures that own behaviour is consistent with words
Listening to concerns	Listens to, acknowledges and values employee inputs/opinions; Encourages staff to be open and express any concerns about safety; Listens to input from employees regarding safety issues
Implementing improvements	Acts to correct safety deficiencies, unsafe behaviours and circumstances; Communicates lessons from safety events; Identifies, records and rectifies safety hazards; Shows concern/acts to fix safety problems, and reports back on results
Acting justly	Communicates understanding that humans are fallible and will make errors; Treats people consistently and fairly – follows a 'just culture' policy
Seeking to understand	Asks 'how is safety?' (enquires about safety 'health'); Enquires about the reasons for 'inappropriate' behaviour; Asks why incidents happened
Shaping behaviour	Reacts appropriately when good/bad safety behaviour is observed; Challenges people about inappropriate actions/behaviour; Corrects inappropriate actions/behaviour promptly; Recognises positive safety behaviours, e.g., reporting of events
Being wary	Seeks information on future risks; Displays a questioning attitude about the way we do things here; Follows up to ensure safety responsibilities are being carried out; Demonstrates a desire to learn

from safety events.

A recent related IAEA publication is the IAEA Leadership Blueprint (International Atomic Energy Agency, 2011), which presents a comprehensive taxonomy of general leadership behaviours, customised for the nuclear power industry. Although the leadership model does not focus specifically on safety-directed actions, it provides a useful template for developing and describing these (to be discussed further in Section 5 of this report).

Commercial Aviation

The discussion of safety leadership in commercial aviation has tended to focus on developing the non-technical skills of pilots, rather than on improving the decisions and actions of senior airline managers. This is not to say that senior managers in the industry do not need to understand how their judgements and decisions impact on safety, but that historically, accident investigations tended to focus on 'pilot error' and therefore on solutions to improve safety by influencing the behaviours of front line workers, rather than more systemically. Training programs like Crew Resource Management (CRM) are now routinely conducted, to enhance non-technical skills in areas such as error management, teamwork, risk management, decision making and certainly leadership. In most major airlines, CRM is built around a non-technical skill or competency framework, depicting behaviours designed to assure safety in an operational environment. Table 6 shows the Leadership skills from a generic Non-Technical Skill System (NOTECHS) developed in 1998 by a panel of aviation human factors experts in Europe (Flin, Goeters, Hörmann & Martin, 1998).

Table 6
Aviation: Non-Technical Skills (NOTECHS) for Flight Crew:
Leadership and Managerial Skills

Element	Behaviours
Use of authority and Assertiveness	▪ Takes initiative to ensure crew involvement and task completion ▪ Takes command if situation requires, advocates own position ▪ Reflects on suggestions of others ▪ Motivates crew by appreciation and coaches when necessary
Providing and maintaining standards	▪ Subscribes to SOPs, makes sure crew comply with SOPs ▪ Intervenes if task completion deviates from standards ▪ With crew being consulted, deviates from standards if necessary ▪ Demonstrates will to achieve top performance
Planning and coordination	▪ Encourages crew participation in planning and task completion ▪ Plan is clearly stated and confirmed ▪ With crew being consulted, changes plan if necessary ▪ Clearly states goals and boundaries for task completion
Workload management	▪ Distributes tasks among the crew, checks and corrects appropriately ▪ Secondary operational tasks are prioritised to retain sufficient resources for primary flight duties ▪ Allots adequate time to complete tasks ▪ Notifies signs of stress and fatigue

Note: Other NOTECHS categories of behavioural markers (not shown here) were Cooperation, Situation Awareness, and Decision Making.

Air Traffic Management

Additional safety leadership developments have taken place within the Air Traffic Management (ATM) domain. In 2009, EUROCONTROL (the European Organisation for the Safety of Air Navigation) sponsored the development of a *"Safety Culture Enhancement Toolbox"* resource for use by European Air Navigation Service Providers (ANSPs) to support improvement in safety culture. One section of this toolbox referred to desirable behaviours for Air Traffic Control (ATC) supervisors that would contribute to safety (EUROCONTROL, 2009). These behaviours are shown in Table 7.

Table 7
European Air Navigation Service Providers (ATC Supervisors)

Safety Leadership Dimension	Behaviours
(Not specified)	• Set a good example • Remind others why following procedures is important • Be regularly seen around the workplace • Be available and ready to listen to people • Ask questions about what is / was happening • Check frequently to ensure that tasks are being conducted as planned and briefed • Look for conditions that make errors more likely; take action to address these • Give regular advice and feedback • Recognise and praise safe work practices • Correct any unsafe behaviour • Remove pressures or other conditions that promote violations • Stop routine or other violations that occur and may have become accepted practice • Have "bad" rules and procedures changed, for example by notifying these to the relevant person in the ANSP.

The safety culture enhancement toolbox also describes the different roles fulfilled by ATC supervisors:

- As a leader, to promote safety as a high priority
- As a trainer / coach, to ensure operational personnel (Air Traffic Control Officers / Technicians) possess appropriate non-technical skills
- As a role model, to set an example in acting safely, reporting incidents, and being just and fair
- As an auditor / assessor, observing performance, setting and maintaining standards; ensuring compliance with policies and procedures
- As a risk and resource manager, managing workload, staffing, balancing productivity targets with safety goals
- As an information channel, providing information, feedback and keeping managers informed about safety issues and concerns of operators.

Oil and Gas Production

The offshore energy industries have also been actively involved in Health and Safety improvement projects. One such initiative is the "Hearts and Minds" program, originally developed by Shell, and now managed by the UK Energy Institute. The Hearts and Minds program has a strong focus on 'top-down' safety leadership and Table 8 shows the Leadership dimensions and behaviours used in the Hearts and Minds Toolkit (Energy Institute, 2002).

Table 8

UK Energy Industry: Safety Culture Enhancement

(Adapted from the Hearts and Minds safety program, Shell 2002)

Safety Leadership Dimension	Behaviours
Team Leadership	• Involve the team • Ask for current issues and new ideas • Be a role model • Give feedback • Admit to errors • Concentrate on the problem not a person • Concentrate on common goals • Discuss the differences
Motivation and Trust	• Provide freedom to work and experiment (within the approved safety regulations) • Encourage good performance • Show concern • Be consistent
Job Planning	• Plan-Do-Review-and-Feedback • Be prepared for rule breaking • Be proactive • Always have a "Plan B"
Responding to Technical Problems	• Be proactive • Use problems for coaching • Coach your team on how to recognise the problems • Choose your moment to step in

Maritime Industry

The maritime industry has followed other safety critical industries and produced customised material designed to provide guidance on safety improvement. For example, the UK Maritime and Coastguard Agency (MCA) developed the document 'Leading for Safety', as a guide to leadership and people management skills for senior officers in the maritime industry (Maritime and Coastguard Agency, undated). Table 9 shows the Safety Leadership model from this guide, referred to as the ten 'Core Safety Leadership Qualities', and examples of the associated behaviours.

Table 9
Leaders in the Maritime Industry:
'Ten Core Safety Leadership Qualities'

Category	Core Safety Leadership Quality	Example Behaviours (not complete)
Confidence and Authority	1 Instil respect and command authority	Admit mistakes when you are sure you are wrong
	2 Lead the team by example	Always be seen to follow simple, visible safety rules during everyday activities
	3 Draw on knowledge and experience	Ensure that you are up-to-speed on safety requirements
	4 Remain calm in a crisis	Develop excellent knowledge of, and confidence in, the crew's abilities
Empathy and Understanding	5 Practice 'tough empathy'	Encourage crew to provide feedback on their situation, feelings and motives
	6 Be sensitive to different cultures	Ensure as far as possible that one 'working language' is used even in social situations, and that crew have adequate training in this language
	7 Recognise the crew's limitations	Monitor and be aware of the signs of excessive fatigue in crew members
Motivation and Commitment	8 Motivate and create a sense of community	Involve staff in aspects of management, for example development of detailed working and operational practices
	9 Place the safety of crew and passengers above everything	Ensure that safety issues are integrated into other everyday operational activities, including walkabouts, meetings and one to-one discussions
Openness and Clarity	10 Communicate and listen clearly	Implement an 'open door' policy for crew members who wish to see you

Health Care

Additional examples can be drawn from Health Care. In 2004 the UK National Health Service (NHS) published a comprehensive guidance document on recommended steps for NHS organisations to improve patient safety (National Patient Safety Agency, 2004). The steps are shown in Table 10, and being directed towards senior management, represent important actions associated with safety leaders. The second step is directly focused on leading and supporting staff. The example behaviours shown in the table are taken from research based around the 'seven steps' model proposed by Flin (2009).

Table 10
National Health Service (UK) Hospital CEOs

Safety Leadership Dimension	Example behaviours
1. Build a safety culture	▪ Setting out the CEO's clear objectives on the intranet and newsletters
2. Lead and support your staff	▪ Providing clarity and unambiguous messages to staff
3. Integrate your risk management activity	▪ Including systems failures and cost of drug errors in long-term financial strategy
4. Promote reporting	▪ Demonstrate to staff that action happens and things change as a result of safety reports
5. Involve patients and the public	▪ Speaking to patients on the ward and asking them what it is like in the hospital
6. Learn and share the safety lessons	▪ Sending senior staff on patient safety training courses
7. Implement solutions to prevent harm	▪ Providing resources to support the hand washing policy and removing barriers to implementation

In 2003-2004 the Australian Council for Safety and Quality in Health Care (2005) sponsored a project to develop a "National Patient Safety Education Framework" to identify the knowledge and performance elements required by all health care workers in relation to patient safety. One of the 22 learning topics identified within the Framework is *'Being a team player and showing leadership'*.

For managerial and executive level staff of health care facilities, the Framework identifies a number of required knowledge and performance elements. They include applied knowledge of: *the principles of good leadership; the characteristics of good team leaders; how to facilitate effective and efficient teamwork;* and *how to enhance and maintain team effectiveness (decision making, listening skills, rewards, encouraging innovation, autonomy and accountability)*. Key performance elements for senior staff include: *Create and maintain effective working teams; facilitate leadership development for staff;* and *show support (leadership) for multidisciplinary teams.*

Rail Industry

Another example comes from the rail industry. Following the example of the global aviation industry, Regulators for the Australian rail industry took action to promote the implementation of non-technical skills training for rail safety workers. Table 11 (from Dédale Asia Pacific, 2007) shows a set of leadership competencies developed as part of a national project to provide guidance on the implementation of Rail Resource Management training (RRM, the equivalent of CRM in aviation).

Table 11
Rail Safety Workers (non-management):
Leadership Competencies

Element	Behaviours
Accountability	Roles and responsibilities are clarified for routine and abnormal situations
Decisiveness	Decisive action is taken when informed of a situation affecting safety
Maintaining standards	Behaviour of team members is corrected if rules or procedures are not applied appropriately
Monitoring performance	Supervisors ensure others follow standard procedures and complete safety-related tasks correctly
Promoting participation	Team members are encouraged to contribute to task planning and completion
Situational leadership	A leadership role is taken on if the situation requires
Authority gradient	An optimal authority gradient is fostered within the team

Science and Technology

The final example in this section is taken from a US science and technology organisation (Oak Ridge National Laboratory, 2005), where the term safety leadership has also been adopted, and managers are encouraged to demonstrate a set of desirable behaviours. The set of 'Essential for Safety Leadership' behaviours are shown in Table 12.

Table 12
Science and Technology Laboratory (US): Managers

"Essentials for Safety Leadership"
1. Communicate performance expectations regularly, consistently, and sincerely
2. Ensure there are adequate resources to accomplish work safely
3. Demonstrate caring for the people and the work they do
4. Hold managers and individuals accountable for safety and compliance with requirements
5. Lead by example -practice safe behaviours at all times and comply with all requirements
6. Regularly conduct both formal and informal workplace observations and coaching
7. Actively monitor safety performance and the effectiveness of improvement actions
8. Always have a questioning attitude – avoid complacency and continuously improve
9. Respond receptively to feedback on personal performance
10. Reinforce safe behaviour and reward safety

5. Evaluating Safety Leadership

This section of the report describes a range of processes that can be used to obtain information about the nature and quality of safety leadership in an organisation. These processes are described in five categories, based on the distinct form of evaluative data they provide and the organisational group targeted for evaluation. The first category reviews three approaches for evaluating the performance of individual leaders. The second discusses survey techniques for gathering data on safety-related beliefs, attitudes, knowledge and behaviour. The third category provides examples of multi-faceted approaches to improve safety leadership as part of a broader safety culture enhancement project. The utility of safety event analysis is then described as another source of information on the quality of leadership performance. Finally, the benefits and limitations of safety assessment processes are outlined.

Individual Performance

Performance appraisal systems

Performance appraisal systems are now found almost universally in medium to large businesses throughout the world. They are designed to support the delivery of organisational objectives (levels of productivity, profit, safety etc.) by ensuring that employees have, or can develop the necessary competence to perform their job, and by managing the work activities of each employee.

The discussion in Sections 1 and 2 above confirms that safety leadership is clearly a desired competency for managers in safety critical industries, because of the direct impact leaders have on other employees, and ultimately on the organisation's safety culture and performance. The performance appraisal system is thus an ideal vehicle for prescribing the safety-related competencies that are important to the organisation. This focus on non-technical skills – encouraging managers and supervisors to demonstrate specified behaviour, is different from, but compatible with appraisal systems that focus on different performance outcomes, such as production levels or Lost Time Injury (LTI) rates.

The IAEA "Leadership Blueprint" (International Atomic Energy Agency, 2011) referred to in Section 4 is a comprehensive competency model for leaders in the nuclear industry. The recommended behaviours designed for general work situations and interpersonal interactions (*Giving direction*, *Making decisions* etc) can be applied equally well to work contexts where safety is a consideration. For example, in the element *Providing 'in front' leadership*, the expected behaviour is '*taking the lead, being visible, making things happen and inspiring staff to follow me*'. In an industry where the most critical decisions involve judgements on safety matters, there would seem to be scope to develop specific safety leadership competencies, which could then be used to evaluate the performance of managers throughout their careers.

To be valid, reliable and fair, the evaluation of non-technical skills should be based on a structured competency framework. This means that the desired behaviours, for managers at a particular level, are relevant and clearly-defined, are observable, and

can thus be measured with some objectivity. Further information on the attributes of a good competency system is provided in the second report for this project.

The 360 degree feedback process

The 360 degree feedback process is an advance on traditional performance appraisal systems where an employee's performance is evaluated by one person – typically their immediate manager or supervisor. In contrast, 360 degree feedback is more balanced, being a combination of performance ratings from the employee themselves, their supervisor, a selection of their peers and some of the team members they supervise. The ratings made are based on agreed competencies relevant to the job and understood by all of the people involved in the process. Ratings are then summarised and reported as averages, or in the form of comparisons between for example, self-ratings and other people's ratings. The purpose of 360 degree feedback is usually to guide development, but there can also be consequences attached if important behaviour is not being demonstrated adequately.

The 360 degree feedback process is ideally suited to the evaluation of safety leadership competence, and is already being used for this purpose. The Hearts and Minds program (Energy Institute, 2002) includes a multi-source feedback tool called SAFE, designed to allow managers to compare their own perceptions about their commitment to safety with how other people see them. A similar tool is available online, customised to safety leadership competence requirements in the Australian mining industry. [2]

Flin (2003) recognises the importance of measuring leadership's commitment to safety, and advocates the use of both climate surveys (see section 5.2) and upward appraisal for this purpose. This advice has been adopted by the health care industry in the USA (The Joint Commission, 2009). Flin, Winter, Sarac and Raduma (2009) also reference a 360 degree feedback tool designed around the NHS Leadership Qualities Framework (LQF), covering 15 personal, cognitive and social qualities applicable to health care managers.[3]

Given that 360 degree feedback processes are already in use in the Swedish nuclear industry, and may already cover safety-related behaviours, it would be relatively simple to adapt this approach to focus more specifically on safety leadership. The strengths of 360 degree feedback are the reliability of the data, the confidentiality of the process, and the practical value of the feedback, provided in terms of behaviour that should be maintained or demonstrated more frequently. The confidential nature of the data means that those providing ratings are likely to be honest in their evaluations, compared for example to audit processes where publicly reported actions and behaviour may not always reflect 'how people live'.

Safety leadership competency models

Section 4 above showed examples of the numerous models, taxonomies and 'lists' of safety leadership attributes that have been generated in safety critical industries. Although some of these catalogues are comprehensive, well researched and contain highly relevant descriptors of desirable leader behaviours, few of them meet accepted standards of well developed competency frameworks. They provide good qualitative insight into the attributes associated with safety leadership, but they do

[2] The Jonah Group: http://www.thejonahgroup.com.au/

[3] See www.nhsleadershipqualities.nhs.uk/ for further information.

not provide sufficient structure to serve as formal safety leadership evaluation or development tools.

A competency model is not in itself an evaluation process. It is however an essential tool in any competency-based evaluation systems, such as performance appraisal and 360 degree feedback. Further explanation of the nature of competency models and their applications is provided in the report from Stage 2 of this project.

Employee Surveys

Staff surveys are almost certainly the most commonly-used technique for evaluating safety climate or safety culture. As explained in Section 2, virtually all such surveys contain dimensions concerned explicitly with leadership, and frequently numerous other items that refer to the behaviour and attitudes of an organisation's managers. In a review of 18 separate safety climate questionnaires used in a variety of industries, Flin and her colleagues (Flin, Mearns, O'Connor & Bryden, 2000) found that *Management and Supervision* was one of five dimensions common across all of the surveys. It is logical that leadership features so prominently in safety culture surveys, given the demonstrated influence of senior managers on all aspects of organisational culture (Health and Safety Executive, 2005).

Safety culture assessments thus provide concurrent evaluations of safety leadership across industries and across the management echelons of organisations. In aviation, safety culture surveys have been used to gauge the attitudes and perceptions of aviation maintenance technicians and those of management groups (Smith, 2010). Comparing what employees believe management does with how managers say they behave, for example in regard to dealing with non-compliance or reacting to errors, is a fertile source of information for cultural change processes. For, example, survey results showing clear discrepancies in perception can be presented and discussed in workshops as a step towards ensuring managers really do 'walk the talk'.

A considerable body of safety culture research in the offshore oil and gas industry has been underpinned by survey techniques (e.g., Mearns, Whitaker & Flin, 2003; Mearns, Flin, Gordon & Fleming, 1998). A particular benefit of standardised questionnaires is that they can be re-administered to evaluate changes in safety climate dimensions from year to year. This is also useful data for (safety) leadership development activities, where the return on investment in training or cultural change processes can be measured. As reported earlier, safety climate surveys have also been used in the shipping industry to understand the aspects of culture that affect maritime safety, with a particular focus on leadership (Håvold, 2005).

Another initiative to improve safety culture in the UK oil and gas industry (Step Change, 2000) recommends the use of diagnostic tools in the initial stage of a four-step change process - *Assess, Plan, Do, Monitor*. Climate surveys are one of the proposed diagnostic tools that can be used to assess the current level of safety culture maturity, in particular the key issues that need to be addressed. Guidance documentation on this process notes that behavioural change initiatives have failed in the past in the offshore industry because they did not suit the extant level of safety culture maturity. The authors review six safety climate survey tools, on criteria including their validity, ease of use and applicability to the oil and gas industry.

Ongoing PhD research by Roger (Roger et al, 2010) at Aberdeen's IPRC is focusing on the mechanisms by which senior managers can effectively promote organisational safety, including a proactive safety culture, within the energy production industry (e.g., oil and gas, nuclear). A key goal of this project is to

develop an evidence-based tool (i.e., a questionnaire / non-technical skill taxonomy / checklist) designed to help senior managers assess their safety leadership strengths and weaknesses, identifying key skills and behaviours that underpin effective safety leadership at the senior-level.

A range of safety culture and safety climate surveys has also been developed for use in the health care industry. In a review of 12 safety culture / safety climate assessment studies in health care, Flin and colleagues (Flin, Burns, Mearns, Yule & Robertson, 2006) identified 'management commitment to safety' as the most frequently measured dimension. They cautioned however that most of the questionnaires used were not derived from explicit theoretical models of safety climate, and that basic information about the psychometric properties of the instruments was not provided. This underscores the importance of using well-constructed and validated surveys, if the aim is to make meaningful evaluations of dimensions such as safety leadership.

The strengths of surveys for evaluating aspects of safety leadership are that they: (a) offer data derived from large samples, usually from a representative cross-section of the organisation; (b) facilitate benchmarking and cross-organisation comparisons, where a standard survey is used, even across an industry; and (c) are repeatable, enabling long-term trend analysis and a measure of year-on-year improvement.

Multi-faceted Approaches

Given the recognised limitations of self-report questionnaires, more comprehensive and balanced methods to assessing safety culture have been developed and employed successfully. The multi-faceted approaches to assessing safety culture typically use a combination of quantitative and more qualitative measures, including surveys, group and / or individual interviews, workshops, workplace observation and review of documentation to construct a holistic view of safety culture. Leadership dimensions are addressed and reported on through these diverse data gathering techniques to the extent that leadership features in the underlying safety culture model and agenda of the project team.

The Hearts and Minds Toolkit (Energy Institute, 2002) is an example of a safety culture improvement process that endorses the use of diverse diagnostic tools. These include interviews and workshops, and climate survey tools, although it is noted that both data gathering approaches have strengths and weaknesses. The Energy Institute's documentation also describes a card sorting technique that can be used in a workshop setting to elicit group consensus on the level of safety culture maturity in their organisation. This provides a foundation for identifying improvement actions.

EUROCONTROL's *Safety Culture Enhancement Toolbox* is another example of industry guidance material that advocates multiple assessment methods. In reference to the data collection phase of a safety improvement project, it is recommended that both "quantitative processes (questionnaire surveys) and qualitative processes (interviews, workshops / focus groups, site visits, reviews of historical information and contextual data analysis)" be considered (EUROCONTROL, 2009).

Analysing Safety Events

Unfortunate as accidents and incidents may be, they do offer an opportunity to learn something about leadership behaviour. As articulated by Reason's so-called "Swiss Cheese" Model of organisational accidents (Reason, 1990, 1991, 1997, 2008), the decisions of management across the spectrum of organisational activities sometimes create adverse conditions that make errors and / or violations by frontline workers more likely. In the absence of effective safety controls or barriers, again determined by management priorities, a serious incident or accident is possible.

Reason originally referred to these higher-level accident precursors as the 'fallible decisions of senior managers', and 'line management deficiencies' (Reason, 1991), a harsh but often valid reflection on the imperfections of safety leadership. There are numerous major accident case studies confirming Reason's conceptual model and supporting the conclusion that inadequate leadership is implicated in establishing the preconditions for an accident and / or influencing decisions taken on the day of the event that triggered the serious outcome (see Baker, 2007; Columbia Accident Investigation Board, 2003; Flin, 2009; Vaughn, 1996).

Using a systemic (or root-cause) investigation process after a serious safety event can provide good qualitative information on the nature of leadership involvement. Some systemic investigation / analysis techniques also categorise contributing management decisions or actions according to a set of defined organisational factors, such as Workforce Management, Training, Organisational Culture, Policies and Procedures or Risk Management (e.g., the Systemic Occurrence Analysis Methodology [SOAM]; EUROCONTROL, 2005). Wilpert and Miller (1999) describe similar taxonomies of organisational factors identified as influencing safety in the nuclear industry. After either a single safety event, or by analysing patterns across multiple events, the areas of deficient leadership can be understood in the context of the specific organisational process or function. This insight is particularly useful for planning safety leadership development activities (to be discussed in Section 6 below).

Further information about safety leadership behaviour can be gleaned from a thorough debrief with the people involved in a safety occurrence. Debriefing is a standard process in many industries for learning from a significant event. To be of maximum benefit event debriefs should be conducted in a non-jeopardy environment, supported by a just culture, so that open and complete information is obtained. Depending on how structured such a debrief is, and whether it is based around a non-technical skills framework, it may be possible to collect good behavioural data on particular safety leadership dimensions, such as decision making, team consultation and communication. Safety events analysed in this way make ideal case studies for non-technical skills training such as the aviation industry's Crew Resource Management (CRM) training, and derivative programs in other industries (see Dédale Asia Pacific, 2006; Hayward & Lowe, 2010 for a review).

Safety Assessments & Reviews

Safety assessments, audits and reviews are now well established as components of an effective safety management system in all hazardous industries. Originally embedded in quality assurance programs (see e.g., Hawkins & Pieroni, 1991), inspections and audits had a disproportionate focus on technical issues and procedural compliance, and little regard for softer dimensions of safety, such as culture and human behaviour. Since the 1990s, these approaches have taken progressively greater interest in the assessment of safety culture, and by association, now have greater scope to evaluate aspects of safety leadership.

In the nuclear power production domain, three main types of review have evolved. These are self-assessment (e.g., International Atomic Energy Agency, 1997, 2002b), peer reviews (e.g., World Association of Nuclear Operators, 2012; International Atomic Energy Agency, 2005) and regulatory inspections (International Atomic Energy Agency, 2002c). The extent to which these three processes refer to evaluating safety leadership is summarised in the following sections.

Self-Assessment

IAEA Safety Standards for Safety Assessment require that "Safety assessments are to be undertaken as a means of evaluating compliance with these safety requirements for all nuclear facilities and activities and to determine the measures that need to be taken to achieve safety" (El-Shanawany, 2010, p. 12). The proposed future structure of the IAEA Safety Standards includes seven General Safety Requirements (El-Shanawany, 2010). The second of these (Part 2) is Leadership and Management for Safety, showing the special emphasis now being given to this aspect of nuclear safety. No further detail is provided on how an operator might assess leadership and management qualities, although a reference is made to personnel competence in regard to Assessment of Human Factors, where it is stated that "The safety assessment shall determine whether the requirements specified for personnel competences, associated training and minimum staffing levels for maintaining safety are adequate". Further guidance on leadership and management attributes that need to be evaluated (and developed) is being prepared (Dahlgren Persson, 2009).

In regard to self-assessment of safety culture, the IAEA's *Highlights and Good Practices* document (International Atomic Energy Agency, 2002b) identifies seven organisational factors to be considered in addressing safety culture problems. These include factors directly linked to leadership behaviour, such as management commitment and effective communication, and other factors, such as effective planning, resourcing and competence, where leadership involvement is implicit. This document also describes symptoms of a weakening safety culture, for example violations being tolerated and not investigated, and employee safety concerns not being dealt with promptly. Although qualitative in nature, these symptoms can be linked to management action (or inaction) to generate indicators of safety leadership.

Peer Reviews

The World Association of Nuclear Operators (WANO) has been conducting peer reviews of nuclear power plant operational performance for members for the past 20 years. Between 1992 and 2011 almost 500 WANO peer reviews were conducted, including at least one peer review at every operating nuclear power station in the world (World Association of Nuclear Operators, 2012). Reviews take place over a two or three week period and cover separate operational areas (e.g., Operations,

Maintenance), as well as 'cross-functional areas' where characteristics of the entire organisation are examined, for example, Human Performance and Safety Culture. The reviews are described by WANO as 'an in-depth, objective analysis of operations by an independent team' (World Association of Nuclear Operators, 2011). Reviews are conducted against a standard set of performance objectives and criteria. Given the expertise required of review team members, their independence from the plant being reviewed, and the structured nature of their observations, peer review findings on organisation-wide elements such as Safety Culture are likely to be valid and constructive. Because all review observations and findings are confidential however, that is, reported only to the operator under review, it is not possible to draw any generalised conclusions about the current status of safety leadership within the industry.

The IAEA's peer review program, OSART (Operational Safety Review Team) is designed to enhance safe operation of nuclear power plants in member states, and to facilitate the exchange of knowledge and experience between team members (International Atomic Energy Agency, 2005). OSART missions are carried out only at the request of the relevant Member State, and either directed towards common operational safety issues, or customised to address particular concerns at a plant. The OSART Guidelines describe the eight main operational areas that are typically reviewed and provide advice on the review process. Safety leadership is not specifically identified in the OSART Guidelines, but is alluded to in the areas of *Management, organization and administration*, and under *Training and qualifications – Training programs for management and supervisory personnel.* OSART Mission Highlight reports are published periodically summarising collective findings from the missions undertaken (e.g., International Atomic Energy Agency, 2010). Highlight reports tend to provide quite general information on topics such as leadership, perhaps to avoid identifying weaknesses at a particular site, and thus do not give a holistic picture of leadership competence.

OSART missions can also be requested where a particular need has been identified, for example following a safety incident. In February 2008, a team of experts visited the Forsmark Nuclear Power Plant in Sweden, concentrating its review on Unit 1. The Forsmark peer review had been requested by the Government of Sweden following a safety event at Unit 1 on 25 July 2006. The report of this OSART mission (International Atomic Energy Agency, 2008) gives a depth of insight into safety leadership issues in the form of both general management and oversight weaknesses, and through case study analysis of the 2006 event. The OSART methodology thus provides independent, expert analysis of deficiencies in safety leadership that can be useful to the site involved and to the industry more widely.

The IAEA also sponsors a peer review process focussed specifically on safety culture. The process is outlined in the Safety Culture Assessment Review Team (SCART) Guidelines (International Atomic Energy Agency, 2007), which provide practical advice on preparing, conducting, reporting and following up on SCART missions. SCART missions are undertaken to develop recommendations and safety culture improvements in nuclear organisations. One of the five "Safety Culture Characteristics and Attributes" defined for evaluation is "Leadership for safety is clear". This characteristic is described by the following attributes, each of which is discussed in detail in regard to assessment and observation (International Atomic Energy Agency, 2007, p. 28):

1. Senior management is clearly committed to safety;
2. Commitment to safety is evident at all management levels;

3. There is visible leadership, showing the involvement of management in safety related activities;
4. Leadership skills are systematically developed;
5. Management ensures that there are sufficient competent individuals;
6. Management seeks the active involvement of individuals in improving safety;
7. Safety implications are considered in change management processes;
8. Management shows a continual effort to strive for openness and good communication throughout the organisation;
9. Management has the ability to resolve conflicts as necessary; and
10. Relationships between managers and individuals are built on trust.

Safety leadership attributes defined at this level can be easily adapted into effective questions for review interviews or meetings, and should enable objective evidence to be obtained on the management behaviour associated with good safety performance.

Regulatory Inspections

Inspections at nuclear power plants are an opportunity for regulators to gather first-hand information about any aspect of an operator's activities. For example, in its role as a supervisory authority, the Swedish Radiation Safety Authority (SSM) has a responsibility to:

> "check that those conducting activities involving radiation follow applicable rules and regulations and take responsibility for nuclear safety, radiation protection and nuclear non-proliferation. We do this by, for example, inspecting nuclear power plants and hospitals, as well as industries and universities that use radiation." (SSM website).[4]

As Reiman and Pietikäinen (2010) note, this includes a requirement to ensure that the indicators of safety culture are developed and measured: "SSM expects, as a part of the safety management, that safety culture to be regularly assessed by the licensees and indicators of safety culture can be a useful tool both for licensees and the regulators." (p. 4). They cite earlier research by Reiman and Oedewald (2009) listing the criteria that need to be met for a nuclear industry organisation to be considered to have a 'high level safety culture'. These are:

- Safety is genuinely valued and the members of the organisation are motivated to put effort on achieving high levels of safety
- It is understood that safety is a complex phenomenon. Safety is understood as a property of an entire system and not just an absence of incidents
- People feel personally responsible for the safety of the entire system, they feel they can have an effect on safety
- The organisation aims at understanding the hazards and anticipating the risks in their activities
- The organisation is alert to the possibility of an unanticipated event

[4] Available from: http://www.stralsakerhetsmyndigheten.se/In-English/About-the-Swedish-Radiation-Safety-Authority1/Our-Tasks/

- There are good prerequisites for carrying out the daily work
- The interaction between people promotes a formation of shared understanding of safety as well as situational awareness of ongoing activities.

As with other safety culture models, the role of organisational leaders is implicit rather than formalised in the above criteria. These criteria are also somewhat abstract, and represent outcomes that would need to be inferred from more observable evidence rather than being immediately apparent during a review or inspection.

6. Developing Safety Leadership

This final section describes some on the approaches and processes commonly used in hazardous industries to develop Safety Leadership. Examples are summarised in table form under five categories:

- The 360 degree feedback approach, designed to develop leaders, managers or supervisors through individual feedback;
- Toolkits or comprehensive packages of resources;
- Safety Culture enhancement projects that incorporate leadership development elements;
- Information and guidance material, often provided online, including for example written material, conference proceedings and video; and
- Formal education and training programs, and other techniques for sharing safety experience.

Leadership development approaches are summarised within each of these categories, covering the industry where the approach is used, the target group for development, a brief overview of the process, and references or website addresses where further information can be obtained. The approaches described are examples only, and do not represent an exhaustive list of available resources in the field.

360 degree Feedback Processes

Multi-source, or 360 degree feedback processes have been described previously in Section 5, as commonly used techniques to evaluate safety leadership competence. Implicit in the process of evaluating competence and providing feedback on strengths and weaknesses is an expectation that the subject of feedback will initiate action to develop their competence. Some of the 360 degree feedback processes described previously are summarised here for reference.

Title	**"SAFE". Associated with the Hearts and Minds program**
Industry / Source	Oil and Gas production / Energy Institute, 2002
Target group	Industry managers
Description	Online feedback tool "ideally suited to individuals with supervisory or managerial responsibilities, but it can be used by anyone involved in businesses where HSE has an impact on operations."
References / Avialability	*SAFE appraisal system: Safety appraisals for everyone*. Available from: http://www.safeappraisal.org/cgi-bin/view.cgi?type=showloginpage Energy Institute. (2000) *Hearts and Minds program*. Available from: http://www.eimicrosites.org/heartsandminds/

Title	**Leadership Framework 360-Degree Feedback**
Industry / Source	Healthcare / UK National Health Service (NHS)
Target group	Healthcare staff
Description	Based on the NHS Leadership Framework and designed to develop the leadership skills of healthcare staff, with the ultimate objective of improving patient care and outcomes. Process can be accessed online and includes an interactive Development Guide to support personal development in line with the Leadership Framework competencies.
Reference / Availability	Flin, R., Winter, J., Sarac, C., & Raduma, M. (2009*). Human factors in patient safety: Review of topics and tools.* IPRC, University of Aberdeen, Scotland. Report for Methods and Measures Working Group of WHO Patient Safety. Geneva: World Health Organization. Available from: www.nhsleadershipqualities.nhs.uk/

Safety Culture Toolkits

Safety culture toolkits have been discussed previously in Section 5, where the evaluation and self-assessment features of these tools were described. The examples cited in Section 6 are listed again here for reference. It should be noted that the developmental potential of these resources is variable, in regard to both enhancing safety culture and increasing the prevalence of desirable safety leadership behaviours. Like other tools, the quality and efficacy of the final product is dependent on the skill of the user. Without good motivation, by organisations and individual managers, the interesting and expertly developed informational content of safety culture toolkits will not be converted to new behaviour in the workplace.

Title	**The Hearts and Minds Toolkit (2002)**
Industry / Source	Energy producers / UK Energy Institute
Target group	"everyone in the organisation, from top to bottom" The Hearts and Minds Toolkit has tools suitable for managers, team leaders and workforce at all levels, that are designed to work alongside any existing HSE tools used by an organisation.
Description	"The Hearts and Minds safety toolkit was developed by Shell E&P, based upon 20 years of university research, and is being successfully applied in both Shell and non-Shell companies around the world. Hearts and Minds uses a range of tools and techniques to help the organisation involve all staff in managing HSE as an integral part of their business. Collectively, these tools and techniques are known as the Hearts and Minds Toolkit." (from the Hearts and Minds website)
Reference / Availability	Energy Institute. *Hearts and Minds program*. Available from: http://www.eimicrosites.org/heartsandminds/

Title	**Safety Culture Enhancement Toolbox**
Industry / Source	Air Traffic Management / EUROCONTROL
Target group	General Safety Culture Enhancement tool, containing sections on desirable behaviours for ATC supervisors.
Description	The Safety Culture Enhancement Toolbox is an online product designed to provide information and practical advice for ANSPs on what Safety Culture is, and guidance on how it can be assessed and enhanced. Includes specific information on developing supervisors' safety leadership (C4.2). The important influence that first level supervisors have on safe behaviour in the workplace is emphasised. Six areas of safety responsibility or supervisor 'sub-roles' are described, and a set of ANSP Supervisor Safety Competencies is proposed. It is concluded that the competence to perform effectively in these different roles needs to be actively developed. Section C4.1 addresses the need to educate senior managers about safety and human factors. A broad training syllabus for senior managers is provided, covering topics such as system safety and organisational accident models, human performance / reliability, and Safety Culture.
Reference / Availability	EUROCONTROL (2009). *Safety Culture Enhancement Toolbox for ATM*. Available from: http://www.skybrary.aero/index.php/Safety_Culture_Enhancement_Toolbox_for_ATM

Safety Culture Projects

These include one-off projects and on-going initiatives or activities designed to raise awareness of Safety Culture and influence attitudes and behaviour. A key strength of these projects is their capacity to influence the entire organisation and therefore the context in which individual leaders, managers and supervisors operate. It is also likely that individual managers who are 'out of step' with the desired culture and expected behaviour (for example, by adopting a punitive attitude towards worker errors) will find it difficult to avoid the universal change process.

Title	**SKI Safety Culture Enhancement Project**
Industry / Source	Swedish Nuclear Power industry / SKI (Statens Kärnkraft Inspektion)
Target group	Senior managers at nuclear power generation and support facilities
Description	This project adopted a multi-faceted methodology, including questionnaires, interviews and meetings, to gather information on attitudes and beliefs about safety, work practices and safety-related behaviour across employee levels in Swedish nuclear power plants. A workshop format was used to provide feedback to the senior management team at each site, and to discuss anomalies and divergences in attitudes related to safety culture. A set of positive safety leadership behaviours were developed as a basis for encouraging individual managers to improve their contribution to safe operational performance.
References / Availability	Lowe, A., & Hayward, B. (2006). *Research assignment project 200303008 SKI Safety Culture Enhancement Project, Final Report*. Stockholm: Statens Kärnkraft Inspektion. Lowe, A., Axelsson, L., Hayward, B., & Branford, K. (2008). *Enhancing safety culture and safety leadership in the Swedish nuclear power industry*. Paper presented at the 8th International Symposium of the Australian Aviation Psychology Assoc., Sydney, Australia, 8-11 April, 2008.

A disadvantage of such projects may be that safety leadership is only one of the target areas for change, albeit a very important one, and that the cultural change strategy may not address this dimension in a specific or meaningful way. It is also possible that measures of the degree to which attitudes and behaviour have improved (e.g., change in SC survey results) do not reflect the impact on individual leaders.

Title	**EUROCONTROL Safety Culture Enhancement Programme**
Industry / Source	Air Traffic Management / EUROCONTROL
Target group	Air Navigation Service Providers (ANSPs)
Description	EUROCONTROL provides varied levels of support to ANSPs who want to measure and improve their Safety Culture. A range of tools have been custom-developed, including questionnaires and a Safety Culture Toolbox. A diagnostic questionnaire contains dimensions directly related to leadership (e.g., Senior Management Commitment, Management involvement in safety), enabling survey results to be passed back to management for discussion and action. EUROCONTROL also facilitates external consultant support for ANSPs to conduct comprehensive Safety Culture improvement projects.
References / Availability	Available from: http://www.eurocontrol.int/safety/public/standard_page/Safety_Culture.html

Information and Guidance Material

These resources typically include packages of written information (often web-based) containing ideas, tools and resources for understanding and improving Safety Culture. They target both the development of individuals and the organisation as a whole. An obvious limitation of written information on safety leadership development is that it is passive in nature. It depends on interest and motivation by individual managers to absorb information, and a willingness to learn and change.

Written material

Title	**Leading Health and Safety at Work. Leadership actions for Directors and Board Members.**
Industry / Source	Healthcare / UK Institute of Directors and the Health and Safety Commission
Target group	Company directors, governors, trustees, and other office-holders responsible for health and safety performance
Nature of material	Information booklet on essential health and safety principles. Includes a summary of legal liabilities, a checklist of key questions for leaders, and a list of resources and references for implementing the guidance in detail. Describes a four-point action plan to improve health and safety performance (Plan, Deliver, Monitor and Review). Brief case study reports are used to demonstrate measurable benefits of health and safety improvement programs.
Availability	Available from: http://www.hse.gov.uk/pubns/indg417.pdf

Title	**Safety Leadership in Action**
Industry / Source	Mining / New South Wales Minerals Council, Australia
Target group	Industry managers (Additional sections tailored to other worker groups)
Description	Guidance for managers on activities such as developing a clear safety vision and inspiring people towards it; creating employee engagement; and involving employees in safety activities. Documentation describes a four-step process for improving safety leadership at the organisational level: • agreeing on the organisation's position in regard to safety ("the Vision"), gaining commitment from workers and defining specific expectations; • assessing the 'gap' between "the Vision" and the current situation, determining the areas where improvement is required and consider how the 'gap' will be closed; • agreeing on what needs to be done, the process to be followed, key people, roles and responsibilities for initiating the changes, and group and individual targets; and • providing efficient resources for implementing the changes, determining the systems and skills for implementation and, after implementation, monitoring progress and assessing the value of the change process to organisational goals
Reference	New South Wales Minerals Council. (2005). *Safety Leadership in Action.* Report arising from the 2005 OHS (occupational Health and Safety) Conference. The Enterprise Development Network Pty Ltd.

Written material *continued*

Title	**Leadership for the major hazard industries. Effective health and safety management.**
Industry / Source	Various / UK Health and Safety Executive
Target group	Senior Management
Nature of material	Based on material developed for the offshore industry, but adapted to help leaders in a wide range of onshore and offshore industries to improve their health and safety performance. Two of the four sections in the booklet refer to Health and Safety Culture, and Leading by example. This latter section contains a self-evaluation checklist of 13 desirable actions by managers that would indicate commitment to health and safety improvement.
Availability	Available from: http://www.hse.gov.uk/pubns/indg277.pdf

Title	**"Safe and Sound" (2004)**
Industry / Source	Government / Australian Safety and Compensation Council.
Target group	Senior leadership in government workplaces
Nature of material	Discussion paper on safety leadership in Australian government workplaces. Aims to provide a 'best practice' model for improving OH&S performance, emphasising commitment and leadership from management as opposed to just regulatory compliance.
Availability	Available from: http://www.comcare.gov.au/forms__and__publications/publications > Then search for "Safe and Sound"

Title	**Human Factors Primer for Nuclear Utility Managers**
Industry / Source	Nuclear Power Production / US Electric Power Research Institute.
Target group	Written for nuclear power plant managers.
Nature of material	An early 'Human Factors primer' giving basic information on human factors applications in nuclear power plants. Aim of the document is to "increase plant performance through an understanding of the effects of human factors on plant operations', and to help managers "recognize and make decisions that will progressively improve personnel performance".
Reference / Availability	EPRI NP-5714 Final Report March 1988. Available from: http://my.epri.com/ > Then search for "Human Factors Primer"

Video and audio material

Title	**Human Factors in design and Construction. Regulatory Perspective.**
Industry / Source	Nuclear Power Production / International Atomic Energy Agency (IAEA).
Target group	Nuclear industry managers.
Nature of material	PowerPoint presentation and accompanying videos of presentations at the IAEA Technical Meeting, Vienna, 03 April, 2008. Subtitled "Further needs in the area of management systems, Safety Culture, leadership and preoperational stages of nuclear projects".
Availability	Available from: http://www-ns.iaea.org/downloads/video/ni/workshop-2008-3p/index.htm

Title	**Why Health and Safety Leadership is important.**
Industry / Source	Various / UK Health & Safety Executive
Target group	Directors and Board Members, UK industry
Nature of material	Podcast of a discussion with Judith Hackett, Chair of the HSE Board. Transcript also available. One of a series of episodes on health and safety issues, produced since 2008.
Availability	Available from: http://www.hse.gov.uk/podcasts/2008/leadership.htm Other topics listed at: http://www.hse.gov.uk/podcasts/archive.htm

Conferences / Seminars

Title	**Leadership and Major Accident Risk Seminar, August 2010.**
Industry / Source	Oil & Gas Industry / Hosted by the Petroleum Safety Authority of Norway, OLJEINDUSTRIENS LANDSFORENING, and the University of Stavanger.
Target group	Indicated as 'industry leaders, decision-makers, researchers, regulators, and representatives from employee and employer organizations in the oil and gas industry'.
Nature of material	A seminar dedicated to issues concerning the influence of leadership in preventing major accidents. The aim was to bring together leaders and experts to facilitate the exchange of information and experiences from different perspectives and contexts.
Availability	Available from: http://www.ptil.no/getfile.php/PDF/Leadership%20seminar%2031aug.pdf

Sundry products and resources

Title	Education and safety promotion resources
Industry / Source	Aviation / Civil Aviation Safety Authority (CASA), Australia
Target group	All Industry stakeholders (including for example, travellers), but directed towards aircraft operators.
Nature of resources	A diverse set of resources are provided, including: • Access to Aviation Safety Advisors, who work with the aviation industry to provide safety advice and deliver safety education and training, for example by distributing safety information publications, and advising on industry problems; • Providing safety seminars and workshops; • Publishing and distributing a safety magazine, Flight Safety Australia; • Advice for air travellers; and • Safety promotion campaigns, using a wide range of books, DVDs, CDs and posters promoting aviation safety. The stated rationale is that "Education and safety promotion directly affects safety outcomes by aiding the adoption of best practice safety principles, practices and standards and influencing safety attitudes and behaviours. CASA uses safety communication and education programs to raise awareness of key safety issues. We aim to achieve an informed and safety motivated aviation community addressing their safety responsibilities based on the analysis of emerging issues in the industry." (from the CASA website)
Availability	Available from: http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_91314

Education and Training

Formal programs and courses

Title	Step Change
Industry / Source	Oil & Gas / UK Oil & Gas Industry
Target group	"People in leadership roles at all levels of an organisation".
Nature of program	The Step Change program provides guidance on safety-related skills for managers and supervisors, and a specific safety leadership training syllabus to assist skill development. It is noted that that training programs are most effective if participants are given feedback on their current performance and an opportunity to develop the relevant skills, for example, how to better involve their staff in safety and ho to demonstrate commitment. It is suggested that this approach is likely to be more effective than purely knowledge-based courses.
Reference / Availability	Step Change. *Changing minds. A practical guide for behavioural change in the oil and gas industry*. Step Change Publication. Available from: www.stepchangeinsafety.net

Title	Advanced Safety Leadership (ASL)
Industry / Source	Oil & Gas / UK – BP and Shell companies
Target group	Safety leaders in Well Engineering
Nature of course	In 2003 BP and Shell set up a joint working group to agree common expectations of safety leaders working in Well Engineering. They had concluded that "to further improve performance, safety had to become personal". A group of technical and HSE representatives from BP and Shell, together with contractors and an independent safety consultant, distilled the safety leadership expectations into a set of personal safety behaviours and communication skills. The program comprises a two day highly interactive workshop where participants explore what it takes to be a safety leader. Participants complete personal action plans and follow-up coaching is used to consolidate learning. Werngren, Stewart et al (2005) report: "feedback from both staff and contractors attending the course has been very positive. Initial metrics suggest the course is strongly influencing behaviours, helping to reduce incident rates."
Reference / Availability	Werngren, O., Stewart, D., Staley, B., West, P., & Sawaryn, S.J. (2005). *Advanced safety leadership, A safety course designed specifically for Well Site leaders*. Paper presented at the SPE/IADC Drilling Conference, 23-25 February 2005, Amsterdam, Netherlands. Available from: http://www.onepetro.org/mslib/servlet/onepetropreview?id=00092585

Formal programs and courses *continued*

Title	European Nuclear Energy Leadership Academy (ENALA)
Industry / Source	Nuclear Power Production / European Nuclear Energy Leadership Academy
Target group	Future leaders in the nuclear energy industry
Nature of programs	The European Nuclear Energy Leadership Academy (ENELA) offers courses designed to provide future industry managers with relevant skills and expertise. Programmes are described as 'based on a practice-oriented management and leadership scheme' covering technical, scientific, legal, economic, political, strategic and business aspects. Modules from the 'ENELA Leadership Cycle', a development programme designed for future top-level managers, featuring predominantly technical, business and legal issues. The topic of Leadership, Management and Communication is addressed throughout the course, and includes discussion of safety culture.
Availability	Available from: http://www.enela.eu/

On-the-job learning

The two approaches summarised here were not designed for the purpose of leadership development, but could be used to that end. They involve on-the-job experience or simulated real-world scenarios that enable managers to review their decisions and actions in context, and thus provide an opportunity for learning.

Title	Executive WalkRoundsTM
Industry / Source	Healthcare
Target group	Hospital executives and senior managers
Nature of technique	In this technique, groups of executives accompanied by nurses and other staff conduct weekly visits to different areas of their hospital. They ask about 'near miss' events and the associated conditions, including any system contributing factors. Events are recorded and analysed, and Quality Improvement staff involved to help identify and address root causes. The approach requires 'knowledgeable and invested senior leadership', with leaders who are able to demonstrate their commitment to safety while helping address real safety issues. The WalkRounds™ approach is not designed specifically to develop safety leadership, but observation of more experienced managers could clearly achieve this outcome.
Reference	Frankel, A.., Graydon-Baker, E., Neppl, C., Simmonds, T., Gustafson, M. & Ghandi, T.K. (2003). Patient safety leadership WalkRounds™. *Joint Commission Journal on Quality and Safety, 29*(1), 16-26.

Title	Managerial Scripts
Industry / Source	Developed in a research context (Israeli Army Platoon Leaders)
Target group	Applicable to managers in any industry where the decisions involve balancing safety with competing goals such as production of cost
Nature of technique	The research design presented Platoon Leaders with mission scenarios involving different safety considerations and operational demands, and asked them if they would continue with the mission. The extent to which safety was a priority for individual leaders, together with their leadership style, were related to platoon injury rates. In reviewing this approach, Hollnagel et al (2009) suggest that the method 'could be adapted for use in other organisational settings to reveal managerial risk awareness and decision-making in relation to safety versus production goals'.
References	Hollnagel, E., Woods, D., & Levesen, N. (Eds.). (2006). *Resilience engineering: Concepts and precepts*. Aldershot, UK: Ashgate. Zohar, D. & Luria, G. (2004). Climate as a social-cognitive construction of supervisory safety practices: Scripts as proxy of behaviour patterns. *Journal of Applied Psychology, 89*, 322-333.

Experience sharing

Title	Nuclear Safety INFO – Human Performance section
Industry / Source	Nuclear Power Production / A website created for the purpose of information sharing on nuclear safety related topics
Target group	This resource is open to all professionals in the nuclear industry
Nature of material	A forum for discussing any topics relevant to nuclear safety, sharing experience, seeking advice and learning from each other. It has over 4700 members from all over the world, from the nuclear industry, regulatory authorities, international organisations, universities, etc. The Resources section of the website is being built gradually, with the aim of providing references to freely available publications which might be of use to nuclear safety professionals.
Availability	Available from: http://nuclearsafety.info/human-performance/

Title	"Storytelling"
Industry / Source	Originated in general management (Denning, 2004), as a tool to promote organisational learning and support knowledge management
Target group	Singer and Tucker (2005) suggest that the technique could be used by senior leaders in hospitals
Nature of material	It is suggested that senior healthcare leaders can enhance learning and improve the safety culture by sharing their experience about patient safety events, including stories about personal errors and their potential impact. This is said to have significant benefit by personalising the importance of safety. Listening to other people's experience is also a non-threatening way to learn.
References / Availability	Denning, S. (2004). Telling tales. *Harvard Business Review*, May: 1-7. Singer, S.J. & Tucker, A.L. (2005). *Creating a culture of safety in hospitals.* Stanford University CHP/PCOR Research in Progress Seminar, August, 2005. Available from: http://iis-db.stanford.edu/evnts/4218/Creating_Safety_Culture-SSingerRIP.pdf

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The Swedish Radiation Safety Authority has a comprehensive responsibility to ensure that society is safe from the effects of radiation. The Authority works to achieve radiation safety in a number of areas: nuclear power, medical care as well as commercial products and services. The Authority also works to achieve protection from natural radiation and to increase the level of radiation safety internationally.

The Swedish Radiation Safety Authority works proactively and preventively to protect people and the environment from the harmful effects of radiation, now and in the future. The Authority issues regulations and supervises compliance, while also supporting research, providing training and information, and issuing advice. Often, activities involving radiation require licences issued by the Authority. The Swedish Radiation Safety Authority maintains emergency preparedness around the clock with the aim of limiting the aftermath of radiation accidents and the unintentional spreading of radioactive substances. The Authority participates in international co-operation in order to promote radiation safety and finances projects aiming to raise the level of radiation safety in certain Eastern European countries.

The Authority reports to the Ministry of the Environment and has around 300 employees with competencies in the fields of engineering, natural and behavioural sciences, law, economics and communications. We have received quality, environmental and working environment certification.

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