

Safety leadership: a nuclear industry perspective

Nick Shaw, Principal Nuclear Safety Inspector, Office for Nuclear Regulation, Redgrave Court, Merton Road, Bootle, L20 7HS.

The Office for Nuclear Regulation (ONR) has developed guidance for its specialist inspectors when undertaking assessments of safety leadership (ONR 2022). The guidance is structured upon, and draws lessons from, the SAFER Leadership Model developed by Wong et al (2015) which identifies five specific core behaviours of effective safety leadership. It also provides guidance on the role of senior leadership in setting safety standards and goals, the management system arrangements for encouraging effective safety leadership behaviours and discouraging poor safety leadership behaviours, and the assessment of safety leadership. Although intended for use by ONR's inspectors, the guidance has wider application and may be of value to other high hazard industries and regulatory bodies. This paper provides an overview of the behaviours outlined in the guidance and discusses how it can be used in a real-world context to identify improvements to safety leadership, to enhance both safety and business performance, and outcomes.

Introduction

ONR independently regulates nuclear safety and security at 35 licensed nuclear sites in the UK. ONR also regulates transport and ensures that safeguards obligations for the UK are met. Its duty is to ensure that the nuclear industry controls its hazards effectively, has a culture of continuous improvement and maintains high standards.

The role of leadership in securing good safety outcomes is well established. Investigations into accidents and disasters across all major hazard industries have consistently found the actions or inactions of leaders to be contributory factors. In the nuclear industry, poor safety leadership behaviours were found to be key contributing factors to the nuclear accidents at Three Mile Island (Kemeny, 1979), Chernobyl (IAEA, 1992), Davis Besse (NRC, 2002), and Fukushima Daiichi (Kurokawa, 2013). Conversely, whilst the situation faced was very different to that at Fukushima Daichi, at Fukushima Daini, a sister plant approximately 10 miles to the south, the effective safety leadership behaviours of the site superintendent Naohiro Masuda enabled the plant to survive the earthquake and tsunami without a meltdown or an explosion (Gulati et al, 2014).

In the *Chief Nuclear Inspector's Annual Report of Great Britain's Nuclear Industry* (ONR 2021), the chief nuclear inspector noted that: "intelligence gathered and events across the industry reveal, amongst other factors, shortfalls in leadership that led to deficiencies in organisations' safety and/or security culture and associated performance". Consequently, safety leadership was made a regulatory priority for the remainder of the 2021/22 reporting year and for the subsequent reporting year.

ONR has established its safety assessment principles (ONR, 2014) which apply to the assessment by ONR specialist inspectors of safety cases for nuclear facilities that may be operated by potential licensees, existing licensees, or other dutyholders. The principles presented in the safety assessment principles are supported by a suite of guides to further assist ONR's inspectors in their technical assessment work in support of making regulatory judgements and decisions. In April 2022 ONR published a new technical assessment guide which draws together **safety leadership behaviours** codified in ONR's *Safety Assessment Principles for Nuclear Facilities* (ONR, 2014), the Western Europe Nuclear Regulators' Association *Reference Levels for Existing Reactors* (WENRA, 2020), and the IAEA's *Safety Requirements* (IAEA, 2016). It also draws on high reliability leadership theory (Martínez-Córcoles, 2018) and lessons from high reliability organisations (Weick and Sutcliffe, 2015). Other established sources of relevant good practice published by the Health and Safety Executive were also studied when developing the guide including *HSG65: Managing for Health and Safety* (HSE, 2013a), *Leading Health and Safety at Work* (HSE, 2013b), *Leadership for the Major Hazard Industries* (HSE, 2011), and the *COMAH Competent Authorities Major Hazards Leadership Intervention Tool* (HSE, 2015). The advice is structured upon, and draws lessons from, the SAFER Leadership Model developed by Wong et al. (2015) which identifies five specific core behaviours of effective safety leadership. An effective leader:

- Speaks on safety.
- Acts safely at work.
- Focuses on maintaining safety standards.
- Engages others in safety initiatives.
- Recognises individuals who adhere to safety.

Each of the five dimensions of the model has empirical evidence supporting its positive influence on followers'¹ safety performance (Wong et al., 2015). Conversely, passive leadership (not enacting safety leadership behaviours) has been found to be associated with lower levels of safety consciousness, negative perceptions of safety climate and an increase in safety related events and injuries (Wong et al., 2015). ONR therefore expects leaders to exhibit behaviours that are consistent with the SAFER Leadership Model.

The document also provides guidance on the role of senior leadership in setting safety standards and goals, the management system arrangements for encouraging effective safety leadership behaviours and discouraging poor safety leadership behaviours, and the assessment of safety leadership. These aspects are not discussed here.

¹ The term "follower", in this context, is used to describe the individuals influenced by the behaviours of their leaders: those being led.

ONR's SAFER leadership behaviours

Speaking about safety at work

The first core behaviour is concerned with how leaders speak about safety at work. Communication is an important element of safety leadership as it is how a leader conveys the importance that they place on safety generally and nuclear safety as their over-riding priority specifically. Communication can take many forms and utilise many channels such as face-to-face discussions (in-person or via videoconference), by pre-recorded video, by podcast, by intranet, or newsletter. Effective leaders recognise the value of face-to-face communications at the workplace so they go out on the plant/site and articulate the importance of why nuclear standards and processes are in place in a way which is meaningful for their followers. They genuinely believe that zero harm, error and loss is achievable, and they communicate their belief to their followers to convince them of this.

Effective leaders provide feedback to their followers on the rationale for decisions, particularly where there is a safety versus cost/programme tension. Providing feedback on performance is also important for safety, especially following a safety intervention. The frequent communication of safety as a priority and the provision of feedback on performance have been found to lead to improved safety outcomes (Parker, et al., 2011; Sulzer-Azaroff and de Santamaria, 1980).

Well-intended safety plans often have unrevealed vulnerabilities and people often harbour assumptions which may lead to them being over-confident in their decision-making. To counteract this, effective leaders talk to their followers about potential vulnerabilities in plans and ways to overcome them, and challenge assumptions by exploring the possible consequences of the actions their followers are planning to undertake.

ONR has identified five key behaviours associated with this overarching core behaviour:

- Communicates safety values, safety goals and safety expectations that are consistent with the organisation's policy for safety.
- Communicates the basis for decisions relevant to safety.
- Provides feedback to followers on their safety performance.
- Discusses vulnerabilities in safety plans and ways to overcome them.
- Challenges assumptions about safety.

Acting safely at work

The second core behaviour is concerned with how leaders act safely at work. Effective leaders are role-models. They strive to have flawless personal standards and exhibit behaviours that they want to see in their followers: they know that their behaviour towards safety establishes clear expectations for their followers of what behaviours are acceptable.

Leaders who speak about safety but then behave in a manner which does not reflect this will be perceived by their followers as having poor behavioural integrity (Leroy et al., 2012). Conversely, leaders who have a high degree of behavioural integrity consider safety to be important to them; they do not neglect to correct inappropriate behaviours. This sends a clear message to followers and clarifies behavioural expectations (Halbesleben et al., 2013; Leroy et al., 2012). Effective leaders put safety first, even if doing so has significant cost/programme implications. The behavioural integrity of leaders has been found to improve safety citizenship behaviours such as increases in the reporting of mistakes or increases in interventions when unsafe conditions are observed or suspected (Argyris, 1977).

At times mistakes and detected safety problems go unreported. Effective leaders openly acknowledge their own fallibility, reporting their own failures and mistakes to encourage their followers to report mistakes and concerns of their own.

ONR has identified five key behaviours associated with this overarching core behaviour:

- Acts in accordance with the organisation's policy for safety.
- Makes decisions that consider the importance placed upon safety.
- Resolves conflicts between safety and other goals.
- Corrects inappropriate safety behaviours.
- Acknowledges and reports own safety failures and mistakes.

Focusing on maintaining safety standards

The third core behaviour is concerned with how leaders focus on maintaining safety standards. Commitment and perseverance in upholding safety standards is an important element of safety leadership (Biggs et al, 2013). Perceptions of a leader's commitment to safety increases a follower's willingness to participate in safety activities (Cree and Kelloway, 1997). Effective leaders demonstrate their commitment to safety by going out on the plant/site to monitor for non-compliances and adapt their leadership styles when responding. They use persuasion and influencing strategies, only adopting more direct styles when safety non-compliances are not resolved or where immediate intervention is necessary to maintain safety or compliance with the law.

Effective leaders acknowledge that they cannot deal with everything immediately, particularly in environments where low standards are prevalent. They recognise that their perceived inaction could set a new low standard, so they ensure that their followers understand that they are not ignoring low standards but are instead prioritising and targeting those with the most risk.

Continual monitoring clarifies which safety behaviours are acceptable and which are not, and keeps followers focused on safety (Griffin and Hu, 2013). Effective leaders create a work environment where this is perceived as a positive act rather than threatening. Once a deviation from an accepted standard is detected, effective leaders empower their followers to self-correct and resolve safety problems for themselves, intervening only when necessary to maintain safety or compliance with the law. Effective leaders support their followers in achieving their safety outcomes. Consistently maintaining a visible commitment to safety is challenging so effective leaders strive to keep themselves motivated in their commitment to safety by setting themselves personal safety goals.

ONR has identified five key behaviours associated with this overarching core behaviour:

- Proactively monitors followers' performance to identify safety problems.
- Uses persuasion and influencing to promote safety compliance.
- Empowers followers to self-correct and resolve safety problems.
- Supports followers in achieving safety outcomes.
- Takes decisive action to address unresolved safety non-compliances, to maintain safety or compliance with the law.

Engaging others in safety initiatives

The fourth core behaviour is concerned with how leaders engage others in safety initiatives. Effective leaders energise, encourage, and enthuse their followers. They involve them in safety decisions, facilitate learning, demonstrate care, and create an environment where followers feel safe to raise safety concerns: these have been found to increase effective safety behaviours and reduce ineffective safety behaviours (Hale et al., 2010). A leader's receptiveness to safety information has been found to increase a follower's willingness to raise safety concerns (Mullen, 2005).

Effective leaders engage their followers in safety orientated decisions and activities, regardless of rank or grade. They value a diverse range of views and encourage contributions from sceptics and those reluctant to speak out. They are comfortable with the status quo being challenged and encourage followers to express different views to those of managers. Effective leaders create a learning-friendly environment in which to engage their followers in learning activities.

ONR has identified five key behaviours associated with this overarching core behaviour:

- Involves followers in safety-oriented decisions and actions, regardless of rank or grade.
- Seeks out diverse views, giving due attention to sceptics and those reluctant to speak out.
- Encourages followers to participate in safety learning activities.
- Demonstrates care for the health and wellbeing of followers.
- Encourages the open reporting of safety concerns.

Recognising safety performance

The fifth core behaviour is concerned with how leaders recognise safety performance. Effective leaders pay particular attention to seeking out and congratulating followers who enact good practices. Providing recognition is a key leader responsibility which can be particularly impactful when given to followers who openly admit their own fallibility by reporting failures and mistakes of their own which would otherwise remain hidden. The types of accomplishment which merit recognition should remain constant over time: timely and consistent reward has been found to reinforce desired behaviours (Skinner, 1938).

Well-designed incentive programmes for safety comprising of social praise, recognition, and non-monetary rewards have been found to enhance safety and reduce accidents (Komaki et al, 1978); rewarding employees with non-monetary rewards such as additional break times was found to improve safety compliance (Austin et al., 1996); recognition in the form of feedback was found to have led to improvements in safety behaviours (Zohar and Luria, 2003); rewarding high safety performers with challenging stretch assignments can be effective in increasing job engagement (Saks, 2006).

Reward has been found to be most effective when given for group and individual performance, and when given to all levels of the organisation and especially the front-line workers (Wilde, 1994). Reward perceived to be distributed fairly and in accordance with transparent arrangements has been found to lead to greater employee engagement (Saks, 2006).

ONR has identified five key behaviours associated with this overarching core behaviour:

- Recognises safety accomplishments promptly after they occur.
- Recognises followers who freely report their own failures and mistakes.
- Provides non-monetary rewards to groups and individuals for high levels of safety performance.
- Rewards high safety performers with challenging stretch assignments.
- Distributes rewards fairly in accordance with transparent arrangements.

Application of the guidance by ONR's inspectors

In 2020 ONR published guidance on qualitative research methods to enable its specialist inspectors to undertake targeted assessments of safety culture, assessments of culture change, or to diagnose problems which may be affecting safety performance (ONR, 2020). This document outlines a flexible framework of qualitative research methods including interviews, focus group interviews, observations, and document analysis. These methods are well suited to describing and

understanding phenomena such as safety leadership. The guidance and a case study outlining its application was presented at *Hazards 31* in November 2021 (Shaw, 2021).

ONR's qualitative research guidance advocates the use of a template of *a priori* themes as a means of grouping data for subsequent analysis. The five core behaviours outlined in the SAFER Leadership Model and their respective subordinate behaviours can be used to develop a template of *a priori* themes, an example of which is shown at appendix A. Interviews, focus group interviews and observations can then be undertaken to gather data to establish the frequency and consistency of which the SAFER leadership behaviours are exhibited by leaders of differing levels across an organisation. These insights can be used by ONR's inspectors to influence positive change, to inform regulatory decisions, and to target future regulatory interventions. Dutyholder organisations may also find the insights to be of value to their own leadership development efforts, or may wish to apply the methods themselves to gather their own insights into safety leadership. Readers are advised to refer to ONR's qualitative research methods guidance (ONR, 2020) for a fuller explanation of how to apply these methods.

During its development, ONR's safety leadership guide was utilised alongside ONR's guidance on qualitative methods to assess the safety leadership capabilities of a dutyholder organisation where it was found to be an efficient and effective tool for gathering and analysing data so that insights into the dutyholder's safety leadership capabilities could be established. In this instance the results of ONR's safety leadership assessment were used to influence positive change to the dutyholder's leadership capabilities.

To better prepare ONR's inspectors for applying the safety leadership guidance, ONR invited the lead academic responsible for the SAFER Leadership Model's development, E. Kevin Kelloway, to present an overview of the model to its inspectors. Kevin is the Canada research chair in occupational health psychology and professor of psychology at Saint Mary's University, Halifax, Nova Scotia. A video recording of Kevin's presentation to ONR is publicly accessible on the Hazards Forum's website (Hazards Forum, 2022).

Discussion

ONR's SAFER leadership behaviours, structured upon the SAFER Leadership Model, provide a framework for inspectors concerned with undertaking an assessment of safety leadership. Used alongside ONR's guidance of qualitative research methods, they provide an efficient and effective addition to ONR's regulatory toolkit which complements existing regulatory approaches such as inspection, permissioning assessment, and investigation. The safety leadership guide can be effective in influencing positive change, aiding regulatory decision making, and developing regulatory strategy.

Following the guidance document's formal issue in April 2022, ONR's specialist inspectors are undertaking several assessments across Great Britain's nuclear industry to deliver on the regulatory priority of safety leadership established in the *Chief Nuclear Inspector's Annual Report of Great Britain's Nuclear Industry* (ONR 2021). The guidance is published on ONR's website (ONR, 2022) and is now available for download.

References

- Argyris, C., 1977. 'Double loop learning in organizations: By uncovering their own hidden theories of action, managers can detect and correct errors', *Harvard Business Review*, 55, pp. 115-126.
- Austin, J., Kessler, M. L., Riccobono, J. E., and Bailey, J. S., 1996. 'Using feedback and reinforcement to improve the performance and safety of a roofing crew', *Journal of Organizational Behavior Management*, 16(2), 49-75.
- Biggs, S. E., Banks, T. D., Davey, J. D., and Freeman, J. E., 2013. 'Safety leaders' perceptions of safety culture in a large Australasian construction organisation', *Safety Science*, 52, pp. 3-12.
- Cree, T., and Kelloway, E. K., 1997. 'Responses to occupational hazards: Exit and participation', *Journal of Occupational Health Psychology*, 2(4), pp. 304-311.
- Griffin, M.A., and Hu, X., 2013. 'How leaders differentially motivate safety compliance and safety participation: The role of monitoring, inspiring, and learning', *Safety Science*, 60, p.p. 196-202.
- Gulati, R., Casto, C. and Krontiris, C., 2014. 'How the other Fukushima plant survived', *Harvard Business Review*, 92(7/8), pp. 111-115.
- Halbesleben, J.R.B., Leroy, H., Dierynck, B., Simons, T., Savage, G.T., McCaughey, D., and Leon, M.R., 2013. 'Living up to safety values in health care: The effect of leader behavioral integrity on occupational safety', *Journal of Occupational Health Psychology*, 18(4), pp. 395-405.
- Hale, A. R., Guldenmund, F.W., van Loenhout, P.L C.H., and Oh, J.I.H., 2010. 'Evaluating safety management and culture interventions to improve safety: Effective intervention strategies', *Safety Science*, 48(8), pp. 1026-1035.
- Hazards Forum, 2022. *New ONR guidance on safety leadership*. Available at: <https://hazardsforum.org/new-onr-guidance-on-safety-leadership/>. (Accessed 10 August 2022).
- HSE, 2011. *Leadership for the Major Hazard Industries, INDG277*. Available at: <https://www.hse.gov.uk/pubns/indg277.pdf>. (Accessed: 10 August 2022).
- HSE, 2013a. *Managing for Health and Safety, HSG65*. 3rd Edition. Bootle: HSE Books.

HSE, 2013b. *Leading Health and Safety at Work, INDG417*. Available at: <https://www.hse.gov.uk/pubns/indg417.pdf>. (Accessed: 10 August 2022).

HSE, 2015. *COMAH Competent Authorities Major Hazards Leadership Intervention Tool*. Available at: <https://www.hse.gov.uk/comah/guidance/major-hazard-leadership-intervention-tool.pdf>. (Accessed: 10 August 2022).

IAEA, 1992. *INSAG-7 The Chernobyl Accident: Updating of INSAG-1, Safety Series No. 75-INSAG-7*. Vienna: IAEA.

IAEA, 2016. *General Safety Requirements No. GSR Part 2: Leadership and Management for Safety*. Available at: <https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1750web.pdf>. (Accessed: 10 August 2022).

Kemeny, J.G., 1979. *Report of the President's Commission on the Accident at Three Mile Island: The Need for Change: The Legacy of TMI*, 41. United States: The Commission.

Komaki, J., Barwick, K.D. and Scott, L.R., 1978. 'A behavioral approach to occupational safety: pinpointing and reinforcing safe performance in a food manufacturing plant', *Journal of Applied Psychology*, 63(4), p. 434.

Kurokawa, K., 2013. *The official report of the Fukushima Nuclear Accident Independent Investigation Commission*. National Diet of Japan.

Leroy, H., Dierynck, B., Anseel, F., Simons, T., Halbesleben, J.R.B., McCaughey, D., Savage G.T., and Sels, L., 2012. 'Behavioral integrity for safety, priority of safety, psychological safety, and patient safety: A team-level study', *Journal of Applied Psychology*, 97(6), pp. 1273-1281.

Martínez-Córcoles, M., 2018. 'High reliability leadership: A conceptual framework', *Journal of Contingencies and Crisis Management*, 26(2), pp. 237-246.

Mullen, J., 2005. 'Testing a model of employee willingness to raise safety issues', *Canadian Journal of Behavioral Science*, 37(4), pp. 273-282.

NRC, 2002. *Davis-Besse Reactor Vessel Head Degradation Lessons-Learned Task Force Report*. United States: Nuclear Regulatory Commission.

ONR, 2014. *Safety Assessment Principles for Nuclear Facilities*. Available at: <https://www.onr.org.uk/saps/saps2014.pdf>. (Accessed: 10 August 2022).

ONR, 2020. *Examining Culture in Organisations: Guidance on Utilising Qualitative Methods in Organisational Research*. Available from: <https://www.onr.org.uk/operational/other/td-hoc-gd-001.pdf>. (Accessed 10 August 2022).

ONR, 2021. *Chief Nuclear Inspector's Annual Report on Great Britain's Nuclear Industry*. Available at: <https://www.onr.org.uk/documents/2021/cni-annual-report-2021.pdf>. (Accessed 10 August 2022).

ONR, 2022. *Safety Leadership*. Available at: https://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-107.pdf. (Accessed: 10 August 2022).

Parker, S.K., Axtell, C., & Turner, N.A., 2001. 'Designing a safer workplace: Importance of job autonomy, communication quality, and supportive supervisors', *Journal of Occupational Health Psychology*, 6(3), pp. 211-228.

Saks, A.M., 2006. 'Antecedents and Consequences of Employee Engagement', *Journal of Managerial Psychology*, 21, pp. 600-619.

Shaw, N.J., 2021. 'Influencing improvements in safety culture using qualitative research methods: a regulatory perspective', *Proceedings of Hazards 31*. Online: 16-18 November 2021. Available at: <https://www.icheme.org/media/17626/hazards-31-paper-07-shaw.pdf>. (Accessed: 10 August 2022).

Skinner, B.F., 1938. *The Behavior of Organisms: An Experimental Analysis*. Oxford, UK: Appleton-Century.

Sulzer-Azaroff, B., & de Santamaria, M., 1980. 'Industrial safety hazard reduction through performance feedback', *Journal of Applied Behavior Analysis*, 13(2), pp. 287-295.

WENRA, 2020. *Safety Reference Levels for Existing Reactors*. Available at: https://www.wenra.eu/sites/default/files/publications/wenra_safety_reference_level_for_existing_reactors_2020.pdf. (Accessed: 10 August 2022).

Weick, K.E. and Sutcliffe, K.M., 2015. *Managing the Unexpected*. 3rd Edition. New Jersey: John Wiley & Sons, Inc.

Wilde, G. J., 1994. *Target Risk*. Toronto: PDE Publications.

Wong, J.H., Kelloway, E.K. and Makhan, D.W., 2015. 'Safety Leadership', in Clarke S. (ed) *The Wiley Blackwell Handbook of the Psychology of Occupational Safety and Workplace Health*, pp. 83-110. Chichester: John Wiley & Sons, Ltd.

Zohar, D., and Luria, G., 2003. 'The use of supervisory practices as leverage to improve safety behavior: A cross-level intervention model'. *Journal of Safety Research*, 34(5), pp. 567-577.

Appendix A

SAFER leadership: template of *a priori* themes

Speaking about safety at work

- Communicates the importance of safety
- Communicates the basis for safety decisions
- Provides feedback on safety performance
- Discusses vulnerabilities in safety plans
- Challenges assumptions about safety

Acting safely at work

- Acts safely
- Makes decisions that consider safety
- Resolves conflict between safety and other goals
- Corrects poor safety behaviours
- Acknowledges and reports own safety mistakes

Focusing on maintaining safety standards

- Proactively monitors safety performance
- Persuades and influences to promote compliance
- Empowers followers to resolve safety issues
- Supports followers in achieving safety outcomes
- Takes action to address unresolved non-compliance

Engaging others in safety initiatives

- Involves followers in safety decisions and actions
- Seeks out diverse views (sceptics and those reluctant to speak out)
- Encourages participation in safety learning activities
- Demonstrates care for health and wellbeing
- Encourages open reporting of safety concerns

Recognising safety performance

- Provides recognition promptly
- Recognises followers who report own mistakes
- Rewards (non-monetary) high safety performance
- Rewards high performers with stretch assignments
- Distributes rewards fairly and transparently