

## Safety culture, leadership and enforcement: What does it mean for Seveso inspection?

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There is little doubt that safety culture is a much discussed subject across the high hazards industries and is seen by many to offer a possible solution to avoiding the conditions that pave the way for a major accident. It is also fair to say that the question of what to do with the concept of safety culture confuses and confounds many.

In September 2015 the European Commission's Joint Research Centre (JRC) and the Dutch Ministry of Labour co-organised and convened a three day workshop, one in a series of its annual Mutual Joint Visits (MJV) on the subject of safety culture, leadership and enforcement which involved competent authority inspectors across Europe and speakers from research institutes and several membership bodies. The aim of the workshop was to explore understanding of safety culture, the relevance of safety culture to effective risk management and what this means for the Seveso inspector.

Even though safety culture is felt to be a hot topic it was found that about half of the 250 survey respondents claimed that they were unaware for instance of the concept of the safety culture ladder which ascribes descriptors to organisational cultures ranging from the pathological on the lowest rung to generative on the highest. Clearly there is still much work to do in raising the awareness of these concepts and making them operational for both major hazard operators and competent authorities.

For the Seveso inspector one question which regularly arises, with regard to enforcement, is how to achieve particular results when the regulations are not specific in the requirements and an external measure of compliance is unavailable. This is very much the case when safety management systems are considered and even more so for the topic of safety culture. This paper explores the concepts of nudge, push and force interventions to the inspection of Seveso major hazard establishments and particularly with respect to influencing the leadership of hazardous operations.

### Mutual Joint Visit (MJV) Programme

The Mutual Joint Visit Programme for Inspections under Seveso II was launched by the European Commission's Major Accident Hazards Bureau (MAHB) in Spring 1999 in order to foster an exchange of experience among Seveso inspectors during the initial phase of development of inspection programmes. The overriding goal was to establish a system of mutual support that would promote consistency in requirements for operators throughout the Europe Union and help maintain a minimum standard of quality of inspections. In the short term, it was anticipated that the programme could stimulate and sustain a spirit of mutual co-operation and interest among competent authorities and then over time, such ongoing collaboration would lead to the eventual realisation of the broader goals of the programme.

The MJV programme is a series of annual workshops that allow participating EU Member States and affiliated countries to demonstrate methods used in the implementation of Seveso, and to share relevant information for competent authorities. The competent authorities are required within inspections to carry out a systematic examination of the systems being employed at the establishment, whether of a technical, organisational or managerial nature. Over the past few years, methods, tools and approaches have been developed by inspectors and their organisations to cope with the problems of assessing a subject as difficult to formulate as management. The outputs from the MJV programme are publically available as the Seveso Inspection Series. As a result of the programme MAHB has published volume on several topics which together comprise the Seveso Inspection Series

The workshop held in September 2015 addressed a set of issues which had for some time posed a challenge to inspectors. Whilst the topics of safety culture and leadership have been long been recognised as important to achieving safe operation, the means of assessing them and the role of the inspector in ensuring that particular standards are achieved, i.e. enforcement, have been less clearly defined.

### The Workshop

The workshop was hosted by the Dutch authorities and held on the 16-18 September 2015 in The Hague and involved primarily Seveso inspectors from a large proportion of the EU member states together with presenters from INERIS, European Process Safety Centre (EPSC), Center for Chemical Process Safety (CCPS) and the Energy Institute (EI).

On day 2 of the workshop the hosts organised a visit to a family owned Seveso chemical manufacturer in order for workshop participants to learn about its safety culture journey and observe first- hand how this translates to front line operations.

During the course of the workshop three breakout sessions were organised on the

- Understanding safety culture
- Establishing the relevance of safety culture to effective risk management
- Enforcement approaches to safety culture

This workshop examined how inspection tools and enforcement strategy can be adapted to make a positive impact on site safety culture and leadership with the view of reducing chemical accident risks over the long term. It also sought to provide insights to help inspectors in areas framed by the following questions

- How is safety culture and leadership relevant to controlling chemical risks? What evidence is there that these factors can substantially influence potential chemical accident risk?
- How can inspectors identify the degree to which a site has a strong safety culture and leadership, and what kind of subjective and objective inputs may be useful to making such judgements? What does negative and positive safety culture look like in practice?
- What are barriers that inspectors face in making safety culture part of their overall inspections strategy and what are solutions for overcoming these barriers?
- What are barriers that inspectors face in talking about safety culture and leadership with site operators and what kind of strategies could help influence positive changes in this regard?
- What kinds of tools are available to support inspectors in interventions directed at improving safety culture and leadership?
- What kinds of questions can an inspector ask to understand what factors are influencing the safety culture on the site and if the site has a positive or negative outlook in this regard?
- What kinds of questions can the inspector pose to the operator to help the site understand that it needs to make safety culture improvements?

Safety culture and safety leadership have long been discussed as essential for consistent and enduring control of major accident hazard risks. In recent years, a number of high profile accidents, including Toulouse (2001), Texas City (2005), and Buncefield (2005) have brought attention to the important influence that these factors have in reducing risks at chemical hazard sites. While always a part of the risk management paradigm, future developments in safety management are likely to include safety culture and leadership broadly operational across the vast spectrum of high risk sites. Moreover, EU Seveso competent authorities are increasingly recognising that the government has a role to play in helping sites achieve long term gains in safety management by focusing on these linked issues.

Seveso obligations notably affected by these developments are inspections, safety management systems, safety reports, and accident investigation. Competent authorities may find such knowledge about the use and effectiveness of performance measures useful in both active and reactive situations:

Active situations are situations in which the authority actively seeks to encourage and foster use of these concepts to improve major hazard control on the site.

Reactive situations are defined as situations in which the operator presents such activities as evidence of compliance and the competent authority must perforce evaluate their adequacy in a compliance context.

## Safety Culture

The term 'safety culture' rose to prominence in the 1986 Chernobyl disaster, where errors and the violations of the operating procedures that contributed to the accident were seen by some as being evidence of a poor safety culture at the plant. The Advisory Committee for Safety in Nuclear Installations (ACSNI) describes safety culture as "the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine commitment to, and the style and proficiency of, an organisation's health and safety management as illustrated in Figure 1.

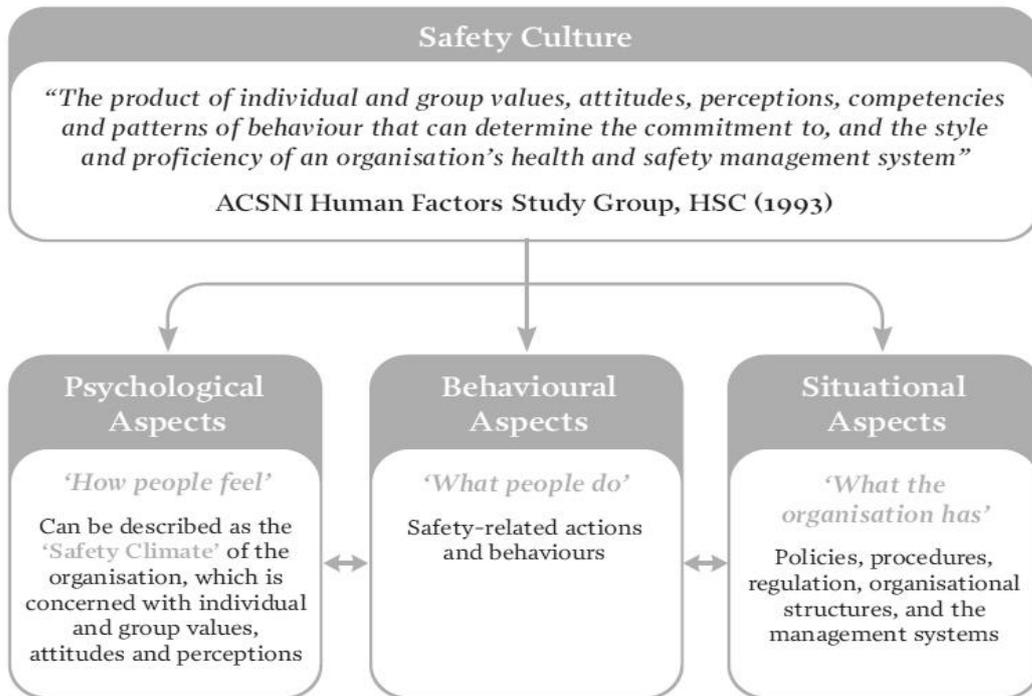


Figure 1 The ACSNI model

The Model (figure 2) based on "Hearts and Minds" – a programme for the assessment and systematic improvement of the safety culture within an organisation – shows a ladder going from "Pathological" to "Generative" accompanied by characteristics which typify the behaviour of organisations at that particular level.

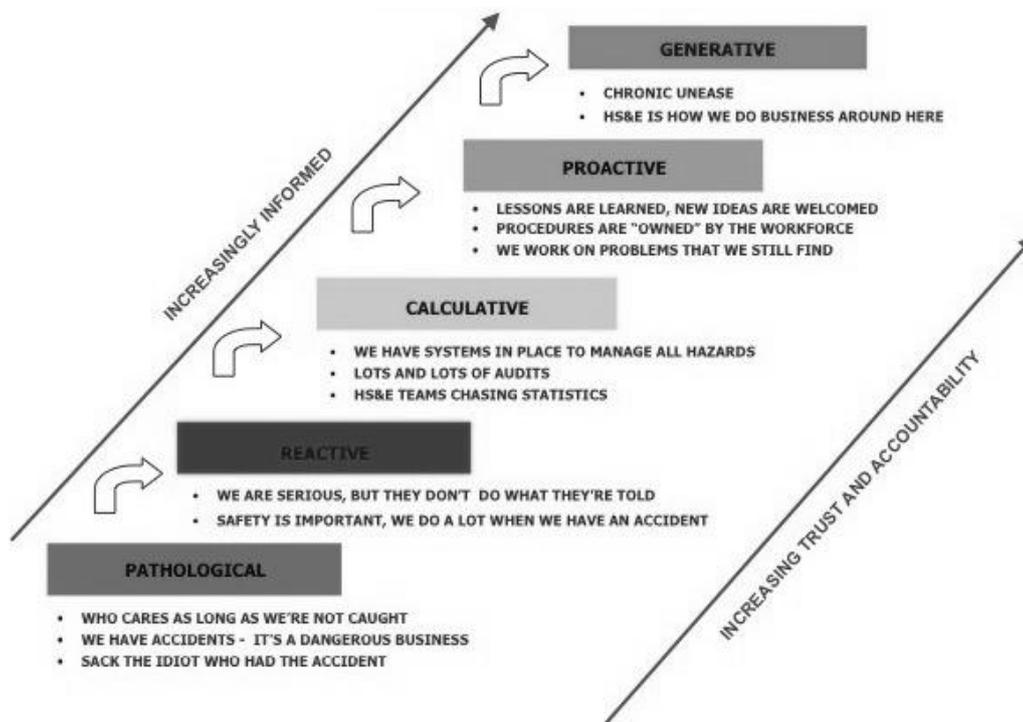


Figure 2 Model based on Hearts and Minds

## Safety culture survey

As preparation for the workshop an online survey was designed and distributed in advance of the workshop to staff working for competent authorities, major hazard operators and other bodies of interest. The survey comprised three sections and invited opinion on the following aspects.

- safety culture definitions and models.
- the influence of safety culture in several well publicised major accidents since across various domains both within and beyond Europe since the seminal Seveso accident in 1976 .
- the priorities and efforts that major hazard operators and authorities are currently according to safety culture improvement actions and interventions.

In all 252 individuals or respondents tackled the survey with the following profile.

Employer Organisation	%
• Major hazard operator	32.5
• Regulator	40.0
• Other	28.5

The respondents were based in the following regions

	%
• Nordic (DK, FI, SE, NO)	41.2
• Central Europe (AT, BE, DE, NL)	17.6
• Southern Europe (IT, PT, GR, FR, ES)	7.7
• Malta /Cyprus	4.6
• UK /Ireland	9.3
• Eastern Europe (BG, HU, PO, TR, RO, HR, MD)	12.4
• Outside Europe	7.2

The first section of the survey concerned opinion on models of safety culture as illustrated in Fig 1 & 2. Respondents were invited to declare their own knowledge or awareness of the models and whether they felt anything was missing from them and assess clarity and usefulness. A question regarding the validity of the 1993 ACSNI model was also posed. The results are summarised in Table 1.

**Table 1:** Summary of opinion on safety culture models

Parameter	Question Type	ACSNI %	Hearts and Minds %
<b>Awareness</b>	Yes/No	38 (Yes)	46 (Yes)
<b>Validity</b>	Yes/No	92 (Yes)	-
<b>Anything missing?</b>	Yes/No	29 (Yes)	21 (Yes)
<b>Clarity</b>	1 (low) – 5 (high)	3.8 average	3.8 average
<b>Usefulness</b>	1 (low) – 5 (high)	3.7 average	3.8 average

When presented the results in Table 1 the workshop participants expressed their surprise about the lack of awareness across the process safety community about the ASCNI and Hearts and Minds models. Clearly there is still much work to do in raising the awareness of these concepts and making them operational for both major hazard operators and competent authorities.

Those survey respondents who made comments on the "anything missing" aspect of the two models stated that the ACSNI model does not take into account any external factors or environment and is predominantly insular. It also does not mention the aspect of leadership. As far as the Hearts and Minds model the overwhelming comment was that it was simplistic to imagine that safety culture homogeneous across a plant or site and their will inevitably be flourishing sub cultures with pockets of excellence and ghettos of mediocrity within the same establishment. Moreover cultures that are stressed or placed under pressure may be act differently when faced with emergencies or abnormal situations compared to stable or normal operation. It was also noted that for several participants a better description of pathological culture is a culture of denial in refusing to even conceive the possibility of a major accident.

In the second section of the survey respondents were invited to rate the influence of safety culture in the following thirteen major accidents

1. **Chemical and process sector:** Seveso (1976), Bhopal (1984), Enschede (2000), Toulouse (2001), Texas City (2005), Buncefield (2005)
2. **Oil and gas offshore:** Piper Alpha (1988), Macondo (2010)
3. **Onshore pipeline:** Ghislenghien (2004),
4. **Nuclear :** Chernobyl (1986)
5. **Space :** Challenger (1986), Columbia (2003)
6. **Maritime :** Herald of Free Enterprise, (1987)

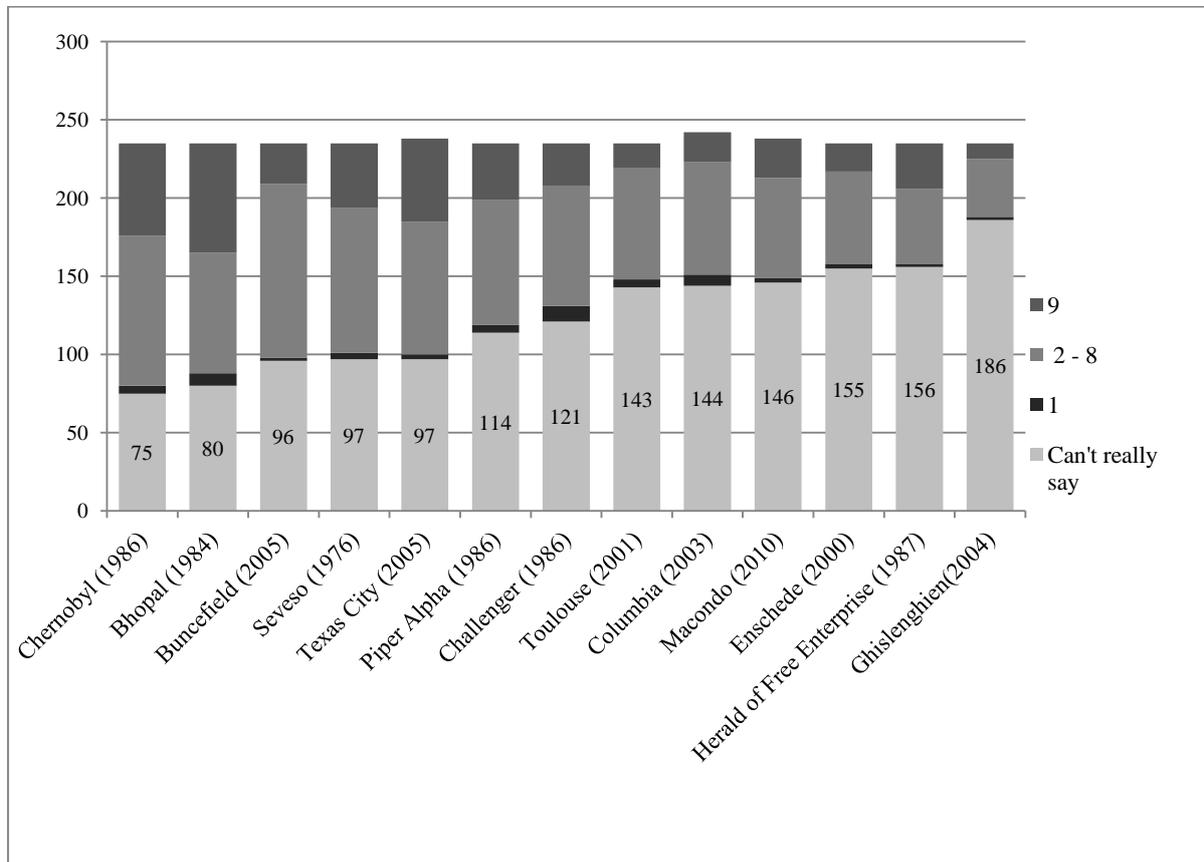
This particular section of the survey used a feature of the software which enabled the accidents above to be presented to the respondent in a random manner in order to reduce order induced biases.

From Figure 3 a significant number of respondents were unable or reluctant to rate the influence of safety culture on these accidents, rising from a third for Chernobyl to about four fifths for the pipeline explosion at Ghislenghien. Put simply the reluctance to assess the impact of safety culture can be down to either a lack of knowledge about the accident or, if known, a doubt about the influence of safety culture. It is perhaps surprising that respondents were more certain about the role safety culture played at Chernobyl since the term itself gained currency in the aftermath of the accident. Figure 3 also shows the opposite poles of safety culture rating for each accident which has been broken down further in Figure 4 to show average ratings.

Fascinatingly the survey saw the emergence of two camps “the culturists” (15%) who were prepared to rate the influence of safety culture across the board for all the listed accidents. Conversely about a fifth of respondents were unable to rate the influence of safety culture at all for each of the listed accidents.

From Figure 4 those that did assess safety culture rated the influence of safety culture most highly for Bhopal and least for Toulouse. The average rating for all accidents shows that there is an inclination to mark over halfway the influence of safety culture on the accident. It was suggested that the high rating for Bhopal might be more down to a perception of national culture and how this impacts on particular safety.

In the final section of the survey respondents were invited to offer a rating on how they saw the principal actors, operators and regulators, pursue safety culture improvements, Those respondents who declared themselves as regulators rated operators, those who were operators rated regulators and those from other bodies were asked to rate how operators and regulators work together to improve safety culture. The results are shown in Figure 5.



**Figure 3** From what you understand to what extent did the influence of safety culture play in the following accidents? (1=low , 9=high) N = 232

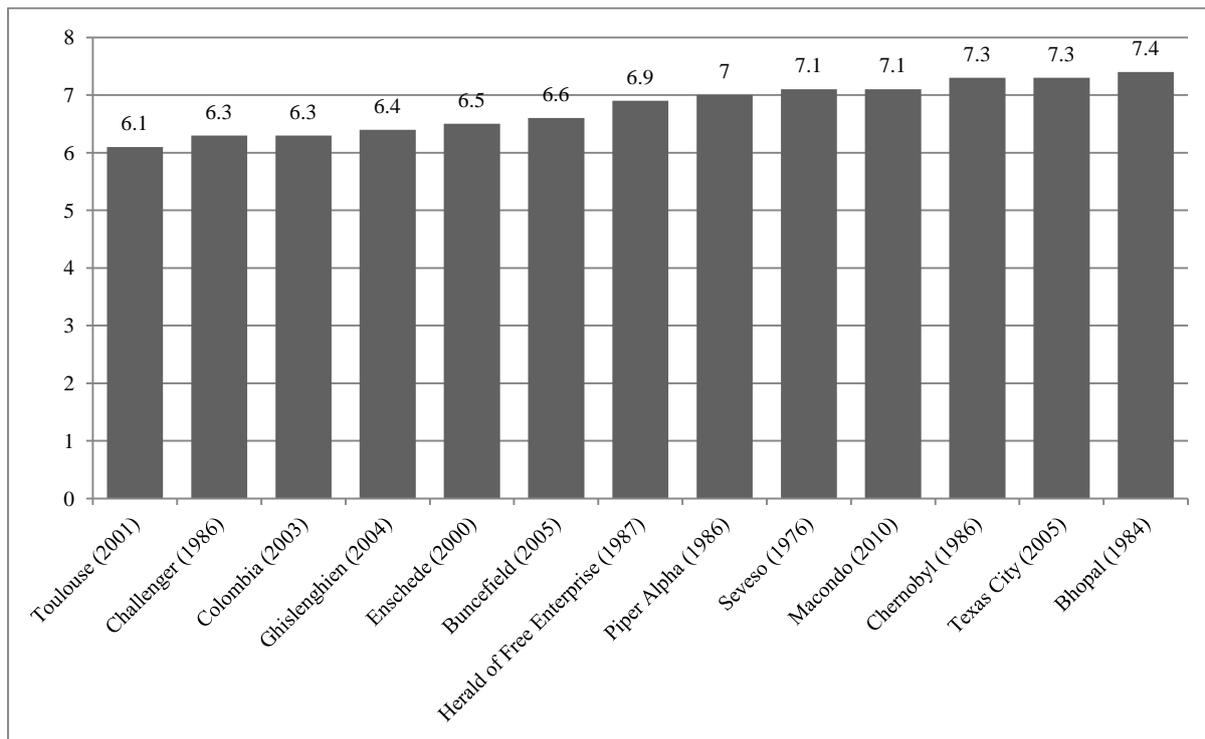


Figure 4 Average of respondents ratings of safety culture (discounting “Can’t really say”) (N = 232)

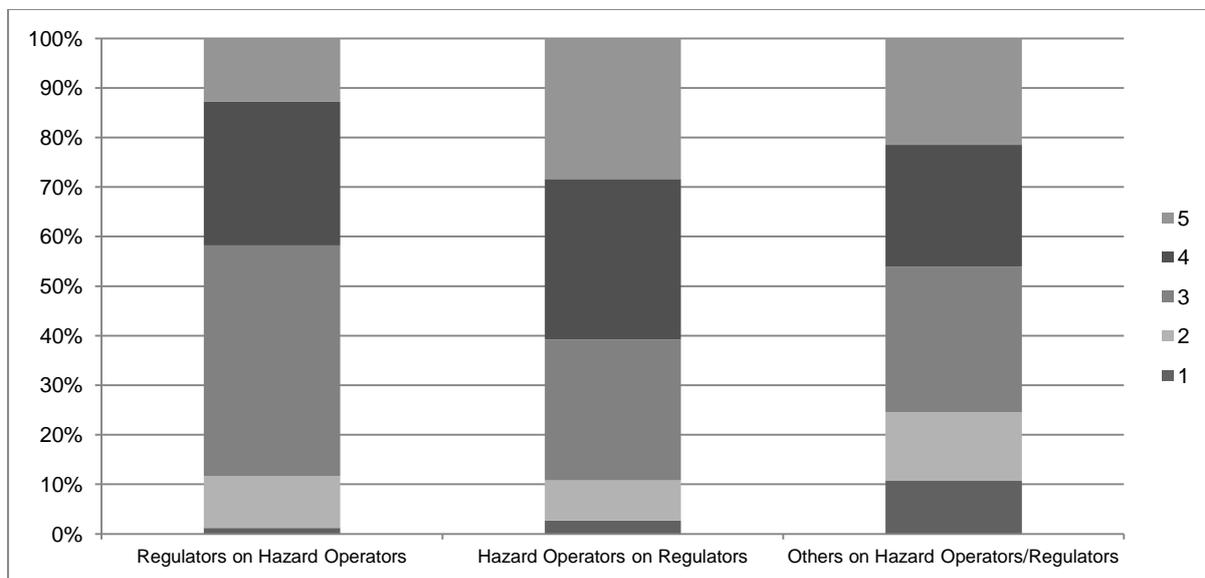


Figure 5 Opinion on the degree to which operators/regulators are pursuing safety culture improvement/interventions (1 = rarely/superficially, 5 = constantly/deeply)

Respondents were also invited to offer their comments after rating the principal players and one of the most voiced factors in support of individual ratings was both organisational and individual leadership in the influence of safety culture.

### Leadership

One of the key aspects which determine the Safety Culture of an organisation is the role performed by the senior leaders and managers. These are the individuals who are involved in developing the policies, regulations and organisational structures and define that which is acceptable in the eyes of the organisation. The Organisation for Economic Cooperation and

Development (OECD) has developed the publication “Corporate Governance for Process Safety” as guidance for senior leaders in high hazard industries. This addresses the role played by senior leaders in ensuring safe operation within the high hazard industries. In doing so it identifies the essential elements of corporate governance and provides indicators to senior leaders whether they are sufficiently aware and informed of the critical aspects of their operations. This publication is currently available in eleven languages.

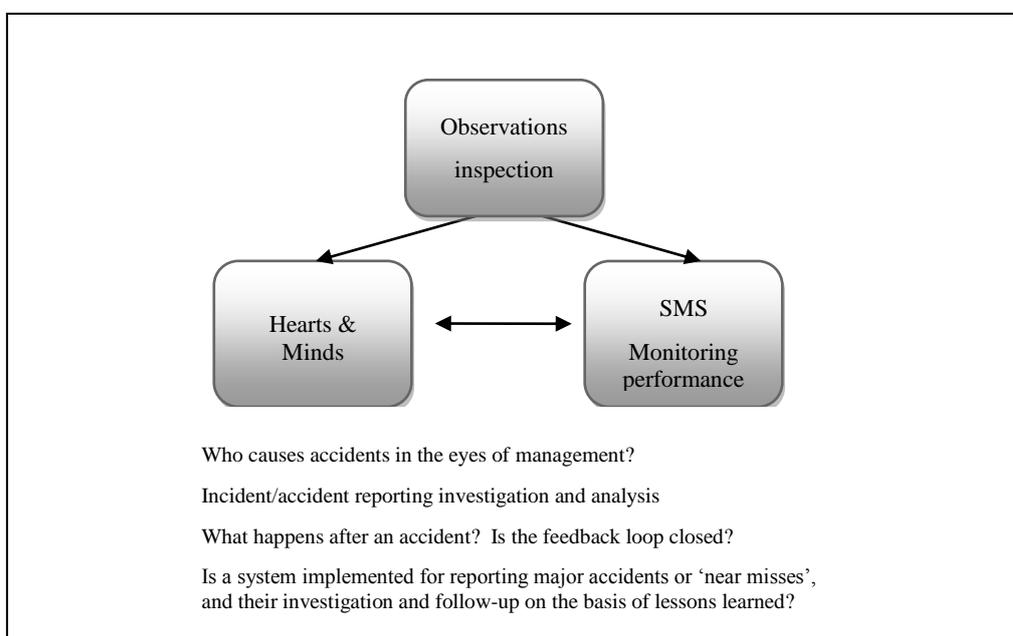
This publication has already been shown to be a useful aid towards engaging with the senior managers of an establishment or a corporation within the “Seveso”-inspection process. In Finland the publication has been developed as an online assessment tool, which then forms a basis for discussion between the management and the inspectors at the on-site inspection. In other countries the publication is sent to senior managers in preparation for the on-site inspection.

For larger organisations, in particular multi-national corporations, communication with senior managers with regard to expectations and requirements of senior leaders has been positive. Small and medium sized enterprises (SME) often struggle with some of the concepts, in part due to the size of the organisation and the short chains between the work-force and the decision makers. This does not however mean that SME are poor performers with regard to leadership. In fact SMEs (often those which are owner lead) with a clear focus on safe operation provide good examples of leadership and a safety culture which is developing. Some of the more difficult organisations to engage with are those which do not see themselves as part of the major accident hazard community (e.g. end-users of chemicals as opposed to manufacturers) or those where the commercial constraints are so tight that spending time and effort on activities which are not an express legal requirement are not recognised as worthwhile.

### Inspection Approaches

The Dutch Labour Inspectorate presented a model (Figure 6) of their approach to addressing safety performance within the Seveso inspection regime. The on-site inspection covers the technical aspects of the major hazard establishment together with the operating behaviour of the staff. Thus the inspection is based around observations.

The Safety Management System (SMS) is the set of processes and procedures to ensure that the correct activities are carried out by the correct people in the appropriate manner and involves managerial control processes; that is the use of performance indicators and senior management review. The “Hearts and Minds” gives an insight into the drivers of diligent operation and effective safety management. Through an inspection approach which looks at the management system and at those people with their beliefs and behaviours which shape the management system the Dutch Labour Inspectorate aim to achieve a deeper understanding of why things happen in the way they do at major hazard establishments. In particular the relationship between the people and the management processes with respect to accidents is considered.



**Figure 6 Dutch Labour Inspectorate’s approach to assessing the safety performance**

One of the questions which regularly arise with regard to enforcement by inspectors is how to achieve particular results when the regulations are not specific in the requirements and an external measure of compliance is not available. This is very much the case when Safety Management Systems (SMS) are considered and even more so for the topic of Safety Culture.

The following proposes a set of strategies which may be adopted. Inspectors need to be aware that there is a clear link between the safety culture and the level of safety performance, and the possible choices which can be made. Three approaches are highlighted “Nudge”, “Push”, and “Force” which indicate three different levels and types of interaction between the inspector and the organisation being inspected. It is important also to note that all of these interaction strategies require commitment by the leadership of the inspection authorities and provision of suitable training for the inspectors.

### **Nudge**

The idea behind “nudge” is that the inspector uses the power of peer pressure, good practice and networks of excellence to support organisations in improving the level of safety culture.

This approach requires that the inspector is aware of what the signs of a good safety culture look like, for example “Safety Maturity Ladder”

Inspectors also need to be aware of who the good performers are in the relevant industries and which networks exist. The management of inspection authorities may need to become actively involved in these networks or to promote their development.

“Nudge” uses suggestion to give the message, “the best do this in this way – are you amongst the best?”

Inspectors are likely to discover that this strategy works for those who are looking to improve anyway and see the inspector as a partner in process safety and are prepared to look critically at their performance. These companies are likely to have a more mature safety culture

The challenge for inspectors is to achieve a level of understanding of safety culture which allows them to interact successfully with the establishments which they supervise.

### **Push**

Push is an approach which is suited to those organisations which need direction in order that they improve. Such organisations respond to stimulus, but are not necessarily proactive in their culture.

This approach requires that the inspector is aware of the degree with which the safety management system is developed and the level of commitment of senior management to major accident prevention within the organisation. The fundamental systems of major accident prevention need to

be in place and steps need to be taken by the organisation to maintain and assure a high level of safety.

This may be the point at which safety culture assessment is appropriate so that the organisation becomes aware of the need to develop ownership and engagement in major accident prevention amongst all employees.

This approach requires that the inspector is aware of what the signs of a good safety culture look like, for example “Safety Maturity Ladder”. In addition the management of the inspection authorities should understand the need that resources are available to provide training and development for their own staff and also amongst industry – this does not mean that the authorities should provide the training, but should be aware of where this may be obtained.

This type of strategy is suited to an inspection programme which is communicated to industry associations so that clear goals can be developed.

Success can only be achieved if the fundamentals of major accident prevention are in place and there is an understanding of the need for continuous improvement.

### **Force**

For those organisations where “Force” is the only strategy option left, then there are likely to be clear deficits in other areas. Inspectors need to assess:

- whether the Safety Management System is adequately developed;
- whether the senior management of the establishment receive regular reports on the performance of the SMS and actively review and take steps to improve performance;
- whether all technical measures are in place to reduce the risks of major accidents as far as is reasonably practicable [all necessary measures].

If the assessment shows that these requirements are not attained, then the deficiencies are likely to be sufficiently well defined to be able to take administrative enforcement measures. Such establishments have a poorly developed safety culture.

It is unlikely that the company will voluntarily enter into programmes to improve the safety culture maturity however discussions with senior management about the authorities’ perception of the establishments behaviour, particularly with respect to the Major Accident Prevention Policy, during inspections could be a useful starting point.

This approach requires that the inspector is aware of what the signs of a good safety culture look like, for example “Safety Maturity Ladder”. In addition the management of the inspection authorities should understand the need that resources are available to provide training and development for their own staff.

Inspectors are trained to look at rational objects and systems but inevitably have to deal with seemingly irrational humans. One presenter described that after an intervention from the authority how a Seveso site brought about a transformation of its safety culture from a low to a high performing operation which included the removal of two managers. Is it possible for sites to transform their culture without the removal of staff that may be deemed to be instrumental in preserving the status quo and blocking safety culture improvement?

## Discussion

At a group and organisational level it is relatively easy to understand how shared attitudes and behaviours can evolve into a shared frame of reference and become custom and practice and “the way we do things around here” which is communicated and copied and ultimately has sufficient influence, to direct individual behaviour.

A mature safety culture has some key attributes:

- It is a ‘just’ culture where the distinction between blame-free and culpable acts is understood.
- It is a ‘reporting’ culture where information on errors and near misses is gathered and analysed.
- It is an ‘informed’ culture, one that knows where the ‘edge’ is without having to fall over it.
- It is a ‘wary’ culture, and one with a ‘collective mindfulness’ that things can go wrong. Defences and contingency plans are in place to deal with these breakdowns.
- It is a ‘learning’ culture in which data gathered is used to guide continuous and wide reaching system improvements and not just local fixes.

These aspects are interdependent in that a reporting culture will normally only succeed if there is perceived to be a just culture. An example of how a mature safety culture works in practice is the reporting of near misses especially those which in different circumstances would have may have resulted in a major incident. In such a case frontline staff will understand that such incidents need to be reported, shared and investigated in order to avoid repetition and hence for the organisation to learn from the near miss. In organisations where there is an absence of good safety culture the staff at the sharp end will be tempted not to report near misses because these incidents are viewed to be “nothing special” or else they fear management reprisals and consequently the organisation as a whole will fail to learn. It is worth noting that a just culture is not a blame free one but is better described as a responsibility and respect culture and as such one of the few truly culpable acts would be a failure to report.

## Conclusion

A number of conclusions can be drawn from the workshop:

- a) Every organisation (including, it was noted, the inspection authorities themselves) has a safety culture. The set of beliefs, behaviours, and norms which define that which is seen to be acceptable. The safety culture may not always be uniform throughout the organisation and mergers and acquisitions as well as locations with very diverse operating characteristics may present a challenge to achieving uniform performance.
- b) Not all major hazard operators are aware of the need to assess the quality of their safety culture and to adopt specific policies and measures to enhance their performance.
- c) The role of senior leaders and managers of an organisation in shaping the safety culture is crucial. Without commitment at the very top of the organisation achieving improvement and maintaining a high level of performance will be highly unlikely.
- d) Inspectors can play a role in highlighting the need for organisations to address the issue of safety culture when considering their overall safety performance. They can encourage and suggest paths to take, however inspectors cannot enforce the achievement of a specific minimum safety cultural level. For those organisations which have a more “reactive” or “pathological” approach to addressing safety, the inspector be required to take a more offensive role in addressing those infringements of statutory requirements which will almost certainly be able to be identified.

The workshop itself resulted in part in recognising that many inspectors are addressing safety culture, but under other labels. After all, what is a safety management system, in its ideal form and fully implemented, if not a positive reflection of a good safety culture? Moreover, the participants learned from each other about how to recognise evidence of safety culture level, strategies for motivating companies to improve, and tools and reference materials available to support these efforts.

Looking towards the future, another field of “high reliability organisations” that of Civil Aviation has adopted clear regulations regarding the application of just culture principles within their industry. It remains to be seen how and when these principles also become adopted within the chemical processing and major hazard organisations.

### Regulation (EU) No 376/2014

Recital (36)

In addition, the civil aviation system should promote a ‘safety culture’ facilitating the spontaneous reporting of occurrences and thereby advancing the principle of a ‘just culture’. ‘Just culture’ is an essential element of a broader ‘safety culture’,

which forms the basis of a robust safety management system. An environment embracing 'safety culture' principles should not prevent action being taken where necessary to maintain or improve the level of aviation safety.

Article 2 – Definitions

(12) 'just culture' means a culture in which front-line operators or other persons are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but in which gross negligence, wilful violations and destructive acts are not tolerated;

Article 16 - Protection of the information source

11. Each organisation established in a Member State shall, after consulting its staff representatives, adopt internal rules describing how 'just culture' principles ... are guaranteed and implemented within that organisation.

The expectation must however be, that operators regularly assess their own safety culture with a view to continuous improvement, that operators are sufficiently concerned to learn about deficiencies from their own workforce (just culture) and that the regulatory oversight provided by Seveso inspectors will look at whether these activities are being carried out and how the operators are achieving the goals of a high level of safety performance.

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