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Problems with safety observation reporting: a construction industry case study

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Abstract

Many large construction organisations use safety observation reporting (SOR) as part of their safety management system on sites, although research around their effectiveness in practice is limited. During an ethnographically-informed research project, the lead author spent three years working with the health and safety team on a large (+£500m) construction project in the United Kingdom with such a system in place. The SOR system encouraged everyone on site to report unsafe acts or conditions, either via computer or handwritten cards, for subsequent action by the health and safety team. Despite good intentions, problems with the SOR system emerged. These included: significantly increased administration to deliver predictable data; poor data quality; an unwelcome focus on the number rather than content of the reports; their use as a tool to ascribe individual or organisational blame; and the perception that the SOR forms were being censored before they reached the health and safety team, which ultimately eroded trust between the workforce and management. Overall, the system as implemented on this site had the potential to cause more harm than good, and both disengage the workforce and frustrate the health and safety team. Although presented as a case study, it is suggested that the research methods used here have been able to expose and illuminate issues that would otherwise go unreported. It is recommended that these issues be considered within the design and implementation of such SOR systems in the future.

Keywords

Safety observation reporting, near misses, safety management, ethnography

1. Introduction

This paper presents findings relevant to Safety Observation Reporting (SOR) from a longitudinal study that placed the lead researcher on a large construction site in the UK for three years. They became a member of the site health and safety (H&S) management team, employing ethnographically-informed research methods (Oswald et al 2017) for data collection and analysis. During the fieldwork, findings emerged that revealed significant problems with what is termed here as SOR. This involved the collection of observational data relating to safety from the workforce, similar to that which occurs as part of near-miss management systems (NMS), or other feedback reports that frequently form part of safety programmes with elements of worker engagement, such as Behaviour-Based Safety (BBS).

It is arguable that such findings could not have been so well illuminated, explored or even perhaps revealed through more 'traditional' research approaches; simply 'being there' revealing issues and problems that could remain hidden to more structured methods of enquiry. Consequentially, this paper does not present an empirical evaluation of the effectiveness of the SOR system as operated on this site by seeking correlations with accident statistics or other quantitative data, and indeed such work with regards to SOR as an integral part of behavioural safety has been carried out much more comprehensively elsewhere (see for example Mullan et al 2015). Instead, this paper retains focus on the *consequences* of the SOR system, as designed, implemented and operated on *this* site, for wider H&S management on the project. In doing so it is able to expose and explore the problems and unintended consequences faced by the H&S management team that, in part, resulted from the adoption of an SOR system without due care and consideration.

These findings are therefore presented as a case study, however it is suggested that the relevance of this empirical work is readily able to extend well beyond such limited boundaries, and can make a valid contribution to both the theoretical foundations that underpin many safety management systems, as well as the designs of worker safety engagement and feedback systems in practice.

2. Context

2.1 Safety in Construction

The construction industry is dangerous. It is considered by some to be a unique working environment; the competitive processes in work-winning, the use of subcontractors and long supply chains, the ever-changing work environment built in-situ, and harsh working conditions can all pose challenges to managing safety (Sherratt 2016). Precise statistics are hard to obtain as under-reporting is common, however it has been estimated that around 60,000 people die on construction sites worldwide each year (Smallwood and Lingard 2009) and levels of injury are equally high. Within the United Kingdom (UK), often considered advanced in terms of its occupational H&S management, rates of construction worker accidents and ill health are still significantly higher than those for other industries. For example, the worker fatal injury rate in the Construction Sector is over three times the average rate across all other UK industries (Health and Safety Executive 2017). Consequentially many different approaches and initiatives for construction safety management have emerged, either adopted and adapted from other industries or created specifically to fit the complex and dynamic construction site environment, with varying levels of success (Alarcón et al. 2016).

2.2 Safety Observation Reporting

As with many industries, people are critical to safe construction work. Unsafe behaviours by workers have long been seen as a key safety management 'problem', a notion grounded in the work of Heinrich (1931) and his claim that '88 percent of all industrial accidents were primarily caused by unsafe acts of persons' (Seo 2005: 188). This statistic has frequently been used as the basis for various interventions, although it must be acknowledged that many other percentages have been put to this claim since (Choudhry 2014) and there have also been strong calls to refute it entirely, not least because it places focus on the control of frontline workers and their unsafe acts (Manuele 2011) rather than any latent, systemic problems within the system (Reason 1997; Whittingam 2004).

Yet as Hollnagel (2014:30) states, 'the idea that human error could be used to explain the occurrence of adverse events was eagerly adopted', and so it is perhaps unsurprising that despite such debates, unsafe acts and behaviours remain a core consideration for safety management professionals. Consequently, SOR by some means – the way in which such acts and behaviours can be determined, reported and monitored – also has a long history as part of organisational safety management practice (van der Schaaf and Kanse 2004). It is certainly found in some form on most large construction sites in the UK. However, SOR is a process that has developed over time and from a number of different foundations, which in turn has at times led to misunderstandings of SOR within wider safety management systems (SMS), and even resulted in misapplication in practice. One fundamental consideration of SOR is the acknowledgement that it is not a standalone method of safety management in and of itself, and should be integrated into a wider process (Cambraia et al 2010) such as BBS, NMR or SMS.

2.2.1 Behaviour Based Safety (BBS)

SOR forms a key part of BBS, itself an approach to safety management that seeks to gather accurate and relevant data which can then be analysed and utilised to inform appropriate interventionist actions. In BBS systems, five fundamental steps are followed: (1) identification of unsafe behaviours within the workforce from accident data or near-miss records, (2) development of appropriate observation checklists, (3) educate and train all involved, (4) observe workers in the workplace, (5) provide feedback, both positive and negative, through verbal, written and graphical means (Cooper 2009). It is worthy of note that SOR itself is only one step (number 4) within this comprehensively proscribed process, and one which should be utilising a focused observation checklist (as developed in step 2) for each BBS intervention.

Results from observation reporting can be used to compute percent safe scores, which can in turn be used in a variety of ways to direct interventions, but are primarily intended to provide on-going safety feedback to the workforce (Cooper et al 1994). However, the effectiveness of this process is reliant on a number of factors. For example, the SOR aspect of BBS should also involve the consideration of contact rate, the number of observations made over a fixed period of time, as research has shown that the more frequently managers and supervisors pro-actively undertake observations, the higher the number of workers that also voluntarily engage in the process (Cook and McSween 2000). Training of those carrying out the SOR within the BBS process is also necessary, be they observers from outside the organisation or direct-line supervisors and managers. In the latter case, management commitment to the process has been found to be essential to achieve significant improvements in safety performance (Robertson et al 1999). The way in which feedback is provided to workers and at what frequency is also influential, and the setting of targets for improvements can provide motivation for the workforce to comply with safe behaviours (Cameron and Duff 2007). If worker training and feedback are not continuously and consistently provided throughout the process, the effectiveness of BBS in instigating improvements is significantly challenged (Duff et al 1993).

Overall, the design of the BBS system as a whole is critical for its success, as Cooper (2009) notes that simply to measure behaviour, through observations, is not enough to sustain incident reduction. A structured approach in terms of regular observations, in static settings, with participative goals is most effective in practice. By adopting such a rigorous and holistic method, BBS has been both theoretically and empirically proven to achieve a reduction in accidents (Li et al 2015, and see also Krause et al. 1999 for a 5-year longitudinal study, Sulzer-Azaroff and Austin 2000 for multiple cases, and Choudhry 2014 for an international construction site case study).

Yet BBS has not been without its critics, and there has been little firm evidence of the success of these types of programmes on large UK construction sites (Health and Safety Executive 2008). BBS has been also challenged by arguments that they tend to 'blame the worker' rather than focus on potential hazards and unsafe conditions within the work environment (see Howe 2000; Frederick and Lessin 2000; Cooper 2003; Dejoy 2005) whilst more significant problems with management and leadership, as noted by Fleming and Lardner (2002), often go unexposed. Hopkins (2006) argues that BBS struggles to be effective in situations in which the workforce mistrusts the management, as they are readily seen as another way to hold workers responsible and accountable, and so can also be influenced by the safety culture of the organisation, which is explored in more detail in Section 2.2.3.

2.2.2 Near Miss Reporting (NMR)

Heinrich (1931) also had considerable influence within the processes of NMR, another safety management approach that also involves SOR and his 'Accident Pyramid' arguably made a significant contribution to safety management practices. Despite Heinrich's own caveats around using his work in this way, causality has become embedded within the pyramid, and a variety of numbers have been allocated to the quantity of near misses/unsafe acts at the base, up through minor and major accidents, that eventually 'produce' one fatality at the top. The pyramid has however been strongly critiqued, for example whilst Townsend (2013) states that 'Safety Can't be Measured' and therefore the 300-29-1 ratios are nonsensical, Manuele (2011:52) simply describes the notion that reducing accident frequency will equivalently reduce serious injuries as a 'myth'. Yet despite such debates, the use of the pyramid remains common practice in safety management, with managers actively seeking to eliminate near misses at the pyramid base to 'prevent' incidents occurring at the higher levels (Choudhry 2014).

There is also an alternative perspective for NMR that does not rely so heavily on the 'causality' within Heinrich's Pyramid, but instead sees near misses as accident precursors in their own right (Wu et al 2010), and the aim of NMR therefore becomes to collect and prioritise these precursor data to develop '… risk-informed interventions and safety improvements and awareness' (Gnoni et al 2017:167). Whichever philosophy underlies the approach, as a consequence of their prominence in safety management thinking, various NMR systems have been developed to provide a mechanism by which near misses can be observed (the SOR aspect of NMR), reported and acted upon in practice.

However, there is no established standard or system for NMR, and so different systems often have different designs and areas of focus (Gnoni 2017). The main objectives for an NMR system have been set out by van der Schaaf et al (1991) as (1) to gain qualitative insight to accident precursors, (2) to gather reliable quantitative data, and (3) to sustain safety vigilance. Within this approach, SOR forms the data collection method, with NMR either carried out by the workforce during their day-to-day activities or by formal observational methods, and as a result appropriate and effective safety interventions can then be instigated (Gnoni et al 2017). As with BBS there are several agreed aspects necessary to establish an effective NMR system. For example, the workforce should be trained in their understanding of near misses including how and what to report and how to differentiate them from unsafe acts or conditions, although in practice they are often combined together (Cambraia et al 2010). The data, once collected, should be interpreted and analysed in both quantitative and qualitative ways, and draw on sophisticated techniques such as Fault Tree Analysis (Gnoni et al 2017). Constant feedback to the workforce is necessary, as with BBS, through daily and monthly formal meetings as well as other dissemination of the information collected. Worker engagement with NMR is considered essential, and research has shown that their consistent and formal involvement in the process also increases the number of reports (Cambraia et al 2010). Indeed, Gnoni et al (2017) argue that NMR cannot be just the SOR, it is the analysis, action and intervention, disseminating and monitoring of the situation that creates an effective NMR system in practice. NMR has been demonstrated to reduce accident rates in line with an increase in NM identification (Cambraia et al 2010); however the potential for over-reporting of near-miss incidents in order to 'appease' the Accident Pyramid is not uncommon. Within the construction industry, quotas are often set for NMR and the quantity of reports can be included as a Key Performance Indicator (KPI) of demonstrable safety management in practice, '…despite the obvious temptation for those responsible for delivery of these quotas to actively seek out (and even produce) any shortfall' (Sherratt 2016:53) and the ongoing debate as to whether the aim should be more or fewer NMS reports moving forward (Gnoni et al 2017).

2.2.3 Safety Culture and Leading Indicators

SOR is also able to contribute to more pro-active safety management approaches and what have been termed the 'leading indicators' of safety (Lingard et al 2017). Leading indicators have been defined by Harms-Ringdal (2009:482) as 'observable measures that provide insights into a concept – safety – that is difficult to measure directly', and have readily gained in prominence (Hinze et al. 2013). However the benefits SOR as a leading indicator can bring to safety management in practice has been debated. For example the lack of standardisation and rigor in the SOR process has itself been noted as cause for concern (Wirth and Sigurdsson 2008), whilst Gnoni et al (2017:158) debate whether the number of near misses reported under a NMS can be '… credibly used as a positive or negative indication of safety'.

Leading indicators are themselves closely associated with the notion of a 'safety culture'; yet safety culture is of course much more than this, and there are some broader theoretical considerations worthy of note here. Reason (1998) suggested that positive safety cultures are typically: *Informed*, where people understand the hazards and risks within their area of operation; *Learning*, where learning is valued as a lifetime process, rather than a requirement for initial skills training; *Reporting*, where employees can share safety information without threat of punitive action; and *Just,* which develops the reporting culture to one with an environment where the workforce know and agree what is acceptable and unacceptable behaviour. A just culture recognises that in some situations there may be a need for punitive action, as negligence and violations are not tolerated by management. In contrast to this, a culture where workers cannot freely share information and are instead blamed and immediately threatened with disciplinary action, can be referred to as a *Blame* culture – a consequence of Reason's (2008) *Person* approach to unsafe acts. A *Person* approach concentrates on individual errors and blames workers for forgetfulness, inattention or moral weakness (Reason 2000), essentially absolving the organisation from responsibility. Such an approach is of course attractive for management (Reason 2008) and as Kletz (2006) notes, accident investigators can be put in a difficult position if an underlying cause of an accident is actually organisational policy or procedure. Despite the emergence of systemic thinking around safety management and accident causality (Dekker 2011), *Person* approaches and thinking remain prominent, perhaps as a direct consequence of the complexities and indeed unpalatability of more nuanced analytical processes.

Perhaps somewhat paradoxically, designers of both BBS and NMR systems are aware of the potential repercussions that such approaches can have on the safety culture of an organisation or site. Both actively promote the development of a no-blame culture, and a direct avoidance of a punitive mind-set when designing a NMR system (Gnoni et al 2017). This goes some way to counter the *Person* approach necessitated by the systems themselves, however it also raises some logistical issues as anonymous reporting would also support a no-blame culture, but should that information be provided then more effective follow up and intervention can be made (Gnoni et al 2017).

2.2.4 Problems with Safety Observation Reporting

Although SOR should form only part of a BBS, NMR or safety culture management system, it is a vital one, and at times the mechanisms and logistics of SOR within such approaches is often taken for granted. For example, in their paper Wu et al (2010) avoid detailing the SOR method used, noting that 'how to obtain near miss and mitigating measures belongs to the sub-system of near-miss reporting', and thereby avoid consideration of SOR in their presented work carried out on construction site near misses. The mechanisms for data collection and therefore SOR are also lacking in Cambraia et al (2010), other than the need for training and engagement of those participating in the process. Yet the SOR aspect of such systems is arguably critical to their overall success, and is itself vulnerable to certain problems.

For example, the sheer volume of SOR data can prove problematic if the organisation and safety management team do not have the right processes in place to manage it (Gnoni et al 2017), as workers are often encouraged to over-report rather than under to ensure everything potentially relevant is captured by the system (Cambraia et al 2010). Furthermore, the reporting of safety-related problems can also raise problems. Van der Schaaf and Kanse (2004) noted that SOR data may be selectively filtered before it is submitted by the observers to avoid the allocation of blame or liability, and fear of discipline can also be a factor of influence on what is reported, including that of legal liability when reporting systems are misused by others. These are factors that can limit engagement with any SOR system, and skew the SOR data received.

Another criticism often levelled at SOR is its true representativeness of actual events (van der Schaaf and Kanse 2004). For example, research has found there can be confusion in what could and should be reported, and so some relevant safety concerns have been found to be frequently underreported such as unsafe conditions (Gnoni et al 2017), creating unconscious bias within the reporting system. This is also due in part to the ‘visibility’ of what is being reported, with the ‘easy-to-see’ forming most SOR data. Fleming and Lardner (2002) summarise this concept in Figure 1 through their spectrum of ‘observability’. For example, within the construction industry, observing behaviours related to Personal Protective Equipment (PPE) and site rules are much easier than observing behaviours that demonstrate leadership commitment or management decisions regarding training or equipment. This limits the SOR data to the lower end of the hierarchy of controls, which includes PPE, and in turn focuses management attention on the least effective accident prevention strategies (Hopkins 2006).

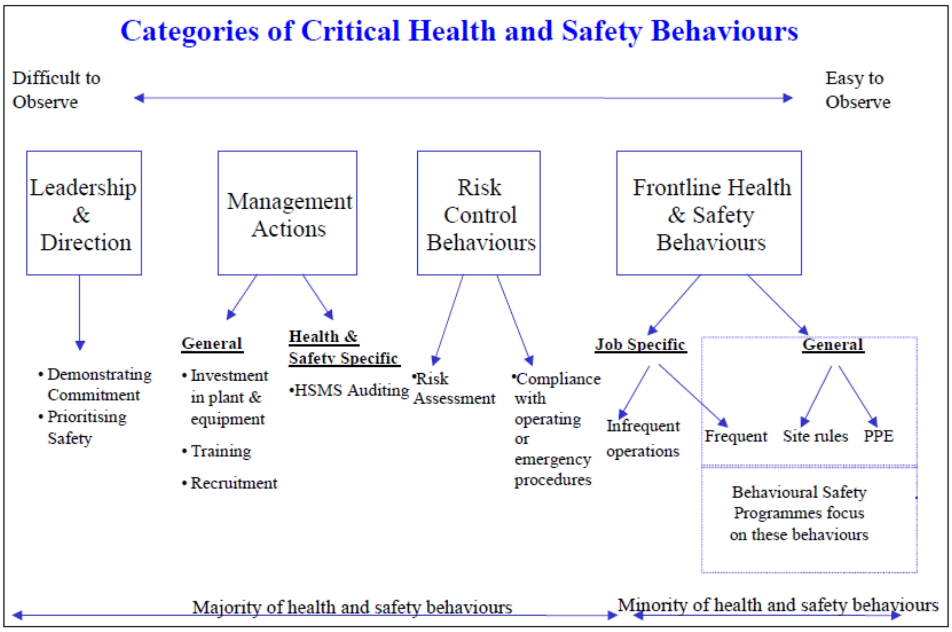

Figure 1: Many H&S behaviours are difficult to see from just simply observing. Source: Fleming & Lardner, 2002

2.3 Summary: Safety Observation Reporting in the UK Construction Industry

SOR is a prominent part of safety management in the UK construction industry, often found as a key component of any site SMS, although reasons for this can be diverse. For example, the analysis of near-misses is deemed to have the potential to be a great addition to precursor data within the construction industry (Wu et al 2010) and therefore SOR under this guise has become standard procedure in the industry. In addition, the increased emphasis on worker engagement, as a contributor to a positive safety culture (Wamuziri 2011) also supports the use of worker-driven SOR as a means of establishing this engagement in a tangible and demonstrable way, providing safety data for shared briefings, discussions and safety committees, through the use of anonymous suggestion boxes for safety improvements and near-miss reporting (Sherratt 2016). SORs can also be used as a readily measurable leading indicator of safety, and so can input easily into safety KPI reporting. The collection of any information about safety is naturally seen as desirable, and SOR can provide reports of unsafe acts and behaviours from all members of the site team, capture good practice, and enable the collation of hundreds of near misses, which are often still considered to contribute to the accident pyramid's promise to prevent the one fatality at the top. It is therefore perhaps unsurprising that SOR systems are now a default inclusion within any large construction site management safety programme, and have become common, if not inevitable, 'best' practice.

Yet this should not go unchallenged. In many cases, SOR has not been adopted as part of a formal BBS system, indeed such focused approaches to safety are relatively rare on UK construction sites as management has shifted towards a safety culture driven agenda. Nor are they always embedded within a formal NMR system, despite the fact that without such a wider context SOR could become ineffective. In addition, the theoretical issues raised around the SOR process at various stages of its development should be examined, and its position as a core proactive safety management tool should be empirically explored (Hallowell et al. 2013).

However, how SORs *can* be explored within the complexities of construction site practice poses an interesting research question; how to empirically examine their actual value in practice to construction site teams (both safety managers and workers) beyond simple metrics, and how to simply reveal how and whether they actually 'work' on sites? This paper presents an offering in answer to this question which emerged organically during the course of a wider study exploring safety culture on a large UK construction site.

3. Methodology

3.1 Research approach

As stated in the introduction, this paper presents only a small yet highly relevant aspect of the findings of a much larger three-year research project, in which the lead researcher joined the case study site H&S management team in the role of a moderate participant-observer (DeWalt and DeWalt 1998) with the overall aim of exploring unsafe acts on a large, multi-national construction project. The role was not one of pro-active intervention: the researcher did not attempt to influence the H&S management processes and practices as they were carried out on the site, and instead simply sought to observe and experience the H&S management of the project as it progressed. In practice this ethnographically-informed approach saw him participate in the daily lives of this team for an extended period of time, allowing him to watch what happened, listen to what was said, to ask questions, and collect any relevant information with the potential to throw light on issues of interest (Hammersley and Atkinson 1995). Such ethnographically-informed approaches, as utilised by Borys (2012), have been found to be highly suited to exploring and representing the everyday practices of people on construction projects, and are indeed becoming a more prominent in the research toolkit of those seeking to better understand the construction industry as a whole (Pink et al. 2013).

While ethnographic inquiry can vary greatly, an important feature is a concern with action, with what people do and why (Hammersley and Atkinson 2007:168), and most behaviours and actions can be fully understood by either engaging in conversation surrounding the behaviour or experiencing the behaviour in action (Murchison 2010: 28). Such engagements allow the researcher to start to understand sentiments and motivations that underlie behaviour (ibid). This work therefore theoretically grounds itself in an interpretivist epistemology, requiring the researcher to explore and depict the subjective meanings of social action (Bryman 2008), as experienced during the research process. Within this theoretical framework, reason is the primary source of knowledge (Schuh and Barab 2007) and there is a necessary belief in the ability of human beings to explain and understand their social world (Uddin and Hamiduzzaman 2009).

3.2 Data collection

An overt research approach was undertaken; the lead researcher did not hide the fact that he was an academic researcher, and was specifically researching safety. Each member of the site H&S team was in charge of a different physical part of the project as a whole, and therefore acted as gatekeepers, easing the passage of the researcher's entry to the field by introducing a range of possible informants and making the surroundings and contexts more visible and understandable.

Data were collected in a number of different ways: through observations and interactions with the site workforce, by participating in site safety walk-arounds, having informal discussions and conversations on-site with operatives, and with the site H&S team both on site and in their own designated office space. The researcher was also involved in formal site H&S meetings and training sessions, and was able to review and analyse the SOR database and fortnightly SOR reports produced from it. Ethnographic research is a reflexive and subjective practice within which the researcher is expected to contribute or participate (Pink et al. 2013), and by becoming part of the site H&S team, seeing what they saw, reading what they read, and being where they were, the researcher was able to immerse himself in the project, the people and the processes that provided the context for the study. The process of data collection involved the use of note-taking both in the field where practical, or as soon as possible after the observation or interaction (Pole and Morrison 2003:26). Low-inference descriptors were used to initially collect the basic observational data, with interpretive comments added, deleted or modified later (LeCompte & Goetz 1982). For example, this involved the use of the 'notes' section of a mobile phone when on-site, typed directly into a computer where one was available in the site offices, or hand-written on minutes when attending safety meetings.

When viewed through traditional research parameters, such an approach can lead to challenges of validity and reliability around the data collected; the researcher can only physically ever be in one place at a time, how do they know that is where the action is, or indeed if this action is typical or not? Whilst it is duly acknowledged that ethnographically informed research is 'inherently partial – committed and incomplete' (Clifford 1986:7), this acknowledgement does not discount its ability to provide relevant insights and illuminations of real-life phenomena in-situ. This can also to some extent be tempered by the extensive time spent in the field, and the growing experience and understanding of the researcher which enabled him to make relevant judgements to 'follow the action' (Goffman 2005) and thereby helped to reinforce and develop his insights as they emerged during his time in the field, rather than compromising them (Shipton et al. 2014).

3.3 Data analysis

The vast amount of data generated by the wider research project necessitated the use of computer software to store, organise and analyse the data collected (Lewins and Silver 2007). Whilst the case study site SOR database was itself available to the researcher, and readily able to provide data which could be examined statistically and thematically, the ethnographic data collected were much more variable and nuanced. These data required careful consideration, and their analysis was initially managed through a coding process. The codes were deliberately kept simple to avoid confusion, and all data collected that related to the SOR system were clearly coded as such: it is the ultimate analytical outcome of the data that has been presented here. It should also be noted that data collection and analysis were a concurrent process (Silverman 2009), with multiple passes of the data supporting the development of the coding framework, as more data were collected and analysed until a point of saturation was reached (Kumar 2005). The process was also informed by the researcher's own experiences of 'being there', and this reflexivity was also able to contribute to the development of a picture of how SORs worked on this site in practice.

3.4 The Case Study and SOR Process

The case study project was a large (+£500m) civil engineering project in the UK. The site averaged around 700 workers, although at peak production this reached approximately 1200. On the project SOR formed an integral part of the safety management system. A bespoke SOR system had been designed and developed by the H&S management team themselves, in an attempt to support a pro-active approach to the management of safety on the site. Although the H&S team included many safety professionals with a considerable number of years of construction safety management experience between them, they had not all worked on a project of this size and scale before. An SOR input could be completed by anyone working on the project in one of two ways. For those without computer access, a pre-printed hard-copy A5-sized card could be manually completed. Early in the SOR process, these cards were initially passed on to their supervisors who in turn passed them to the H&S team, but later in the project the H&S department created an SOR 'box' to which only they had the key and into which SOR cards could be posted anonymously. For those with easy access to computers, the same form could be completed online and submitted electronically through the employee portal which also managed annual leave, training and payroll. Although training was provided for use of the employee portal, no training was provided specifically for the use of the SOR system, and there were no specifically trained 'safety observers' on the site. Anyone from the security guard, to the operatives, to the supervisors, to senior management, to the client themselves could complete and submit a SOR.

The SOR card/online form contained the following boxes for completion:

- Date
- Nature of Observation (tick box):
    - Unsafe Act
    - Unsafe Condition
    - Good Practice
- Category (tick box):
    - Housekeeping
    - Access/Egress
    - Work at Height
    - Behaviour
    - Excavations
    - Traffic management
    - Tools and Equipment
    - Trapping/Crushing
    - Lifting – Mechanical
    - Lifting – Manual

    - Underground Services
    - Overhead Services
    - Lighting
    - Electricity
    - Noise
    - Vibration
    - PPE/RPE
    - Hazardous Substances
    - Permit(s)
    - Signage
    - Welfare
    - Work over Water
    - Diving
    - Hot Works
    - Emergencies
    - Fire
    - Other
    -
- Department (free text)
- Points Noted (free text)
- Action Taken (free text)
- Raised Date (free text)
- Raised By (company name)
- Response (free text)
- Close Date

Following submission, one of the site H&S team 'checked' the cards before they were entered onto the SOR database that was managed within the H&S department. They were, for example, able to check the 'Category' as allocated by the person who submitted the SOR, and could amend it if necessary to a different category, or dismiss the SOR entirely as a non-safety issue. This potential for intervention from the site H&S team must be acknowledged within the process.

The SOR database was deliberately designed to be accessible by everyone on the project, to embed transparency in the process. However, as the database was only available through a computer, in practice this limited access to management and supervisors, whilst workers could not easily access the system to monitor their SORs and track their closure.

The SOR system was used to generate reports which were then imported into MS Excel, through which all open SOR inputs could be collated and interrogated in a number of ways. For example, all SORs relating to work at height could be extracted for closer scrutiny, or reports generated that identified the categories or departments that had seen changes (positive or negative) in their SOR numbers over the project or more recent weeks. The data were also used to create regular SOR reports for dissemination. These fortnightly reports presented the SOR statistics in the form of bar or pie charts or other graphs based on these data. These graphs presented data such as the identification of the 'top three' categories in terms of SOR quantities received over the last fortnight, although no detailed analysis was carried out such as percentage safe score or contact rate of the SORs. This graphical data were also collated into a formal fortnightly 'SOR report' (usually 4 sides of A4 paper) which was issued to the senior project management team, displayed in the site welfare facilities, and discussed under a recurring agenda item of both the weekly H&S team meetings and the monthly worker H&S committee meetings, the latter of which anyone was welcome to attend. The reports were also distributed to the section managers on the site, some of whom also posted them on their section notice boards.

4. Results and discussion

Following the presentation of similar ethnographically grounded work by Borys (2012), the results are organised here as follows: firstly a statistical contextualisation of the case study SORs is provided to illustrate the scope and variance of the data produced by the SOR system in practice. Then the resultant analysis of the ethnographically-informed findings are presented, which revealed the negative and unintended consequences of the implementation of this SOR system in practice. These are explored through the key themes that emerged from the data, which were (i) a lack of useful insights, (ii) quantity: hitting the targets, (iii) name and shame and blame, and (iv) trust in the system.

Illustrative examples are presented from the fieldnotes where appropriate, and all names have been changed to ensure anonymity.

4.1 The SOR statistics

Between March 2013 and July 2014, 3956 SOR inputs were collected on the project. 2128 were categorised as unsafe conditions, 697 as unsafe acts, and 1131 as good practice. At the start of the project no official targets had been set for the number of SORs to be collected, however this timescale has been used due to the significant change in SOR activity on the project from March 2013, and its subsequent development as a notable phenomenon during the field work. It was in March 2013 that the heads of sections started to set informal numerical targets for SOR reporting within their sections, which subsequently led to a jump in SOR activity as shown in Figure 2, in order to meet those requirements. This change in practice is discussed further in section 4.2.2.

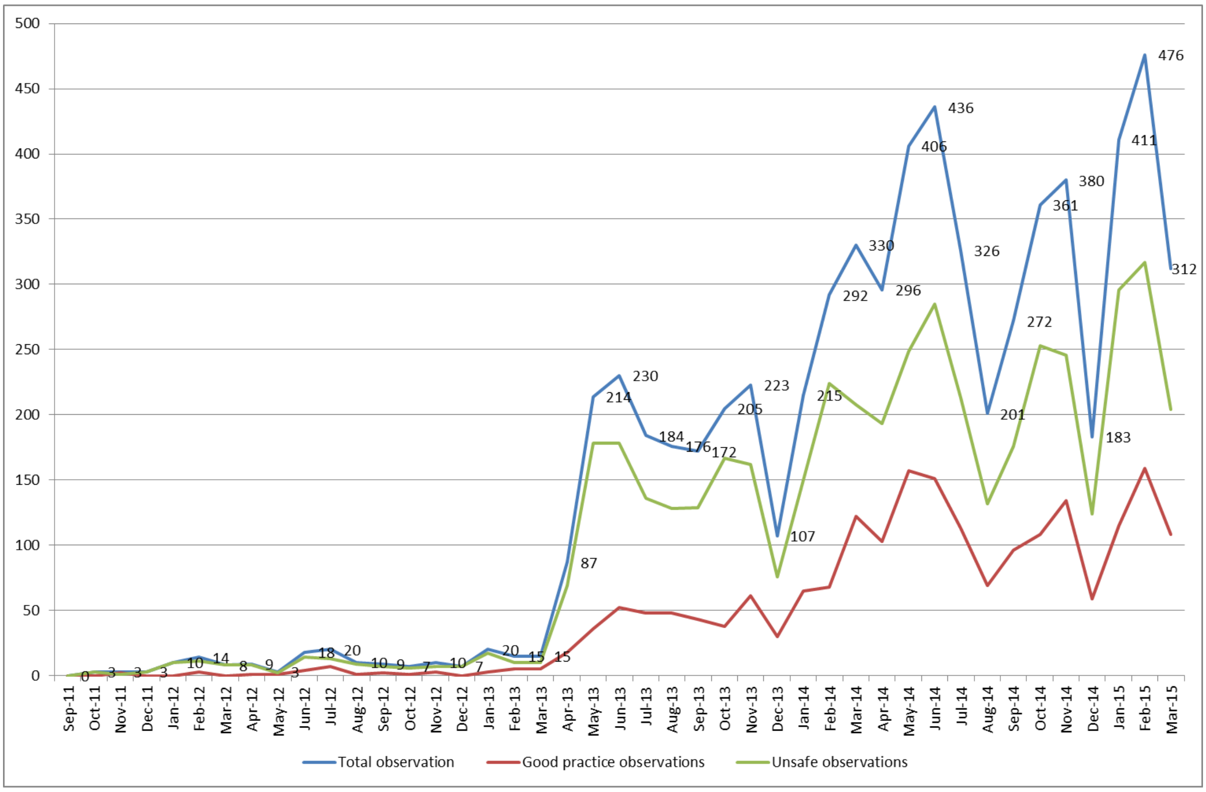

Figure 2: Volume of SOR activity throughout the project.

For the purposes of this paper ‘good practice’ observations have been removed from the dataset, resulting in 2825 records. The distribution between unsafe acts and unsafe conditions, and their associated work categories can be seen in Figure 3.

Just over 75% of the SOR inputs were assigned to unsafe conditions, implying that the majority of unsafe incidents involve situations that are not the immediate consequence of human actions. This could be considered surprising given the common notion that the vast majority of accidents are caused by unsafe acts rather than unsafe conditions; something later confirmed by others (e.g. Lutness 1987; Williamson and Feyer 1990; Salminen and Tallberg 1996). This has resulted in a focus on unsafe acts within the construction industry (e.g. Shin et al. 2014; Oswald et al. 2015), and indeed contradicts the NMR literature which found this categorisation to be under-reported (Gnoni et al 2017). Yet this finding may also be a direct consequence of the SOR process itself. It may simply be a reflection of the difficulties of observing fluid and momentary acts when compared to static and unchanging conditions (Smith et al 2017); in keeping with the theory put forward by Fleming and

Lardner (2002) that an unsafe condition is often much more 'easily observable'. It may also be the result of utilising such such bald categorisations with the SOR system; if no person is present there is therefore no act, despite the fact that an act, or even several, may well have contributed to a condition before it was observed. Indeed, despite the fact that such complexities within accident reporting and causality have been well explored (see for example Hovden et al. 2010; Ferjencik 2011; Smith et al 2017) this SOR system still fundamentally relied on the central positioning of a simple causal dichotomy, act *or* condition, as its starting point for analysis.

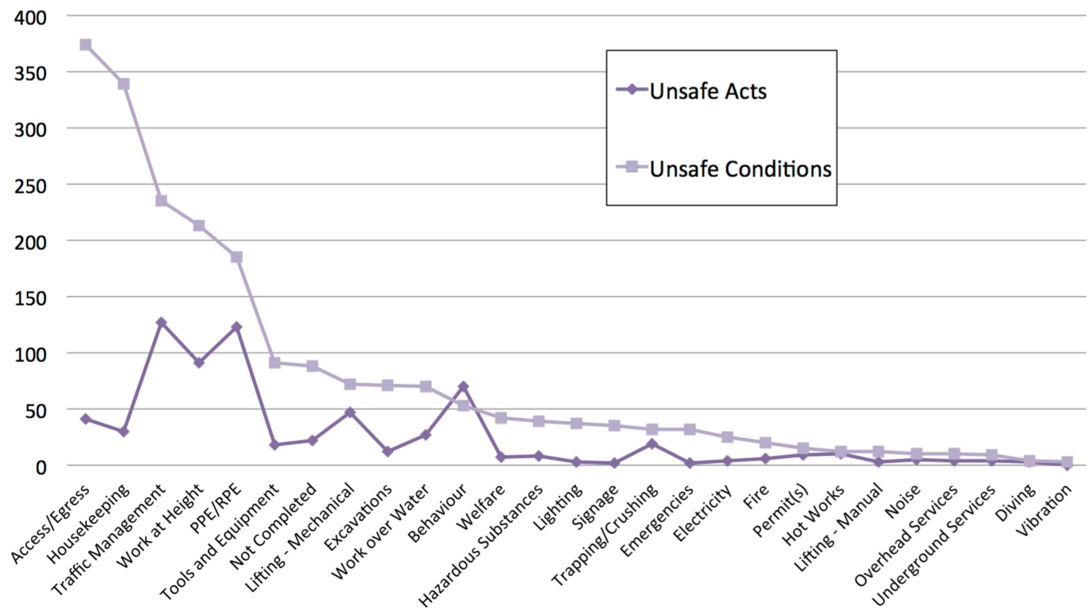

Figure 2: Categorisations of Unsafe Acts and Unsafe Conditions

Also worthy of note is that in all categories bar one the number of unsafe conditions exceeded the number of unsafe acts, with the exception of the category of 'behaviour'. The inclusion of this category in itself is interesting, it is neither a work type (such as work at height or lifting) nor an organisational function (such as lighting or welfare), but relates directly to the individuals working on the project. Its inclusion is a clear manifestation of the *Person* approach to unsafety, providing a way to blame an individual for the act or condition as observed. Indeed, it is again surprising that over 50 'unsafe conditions' were attributed to behaviour, and again this suggests complexities and problems within the nomenclature included in the SOR system utilised here (further discussion of which can be found in Smith et al 2017).

4.2 The SOR process: Ethnographic insights

4.2.1 A lack of useful insights

As shown in Figure 2, SOR forms were most commonly completed in five specific categories: access egress, housekeeping, PPE, work at height and traffic management. All of these readily fall into Fleming and Lardner's (2002) easily observable 'Frontline Health and Safety Behaviours' and were also unsurprising to the H&S management team:

> *'I have filtered them out and again the top three categories in the fortnightly report are Access/Egress, Work at Height and Traffic Management.'*
>
> *'OK, I mean the results are not a lightning bolt in the dark. We already know what is going to come up… we could have predicted it from day one and it is the same over and over again.'*

For the H&S team the SOR system was not revealing anything new. It simply supported their own professional knowledge, and judgements gained from spending time on the site carrying out their own safety inspections. The SOR reports were also highly representative of 'basic' construction safety knowledge, specifically the industry-wide statistics which always place working at height and slips, trips and falls from poor housekeeping within the top causes of accidents (Health and Safety Executive 2017); and which are therefore areas that should naturally receive increased attention in terms of safety management in practice.

Yet, the validation of this knowledge was not particularly welcomed by the site H&S team. The input of their time in managing, compiling and analysing the vast SOR database for such little return was not considered particularly beneficial, and was instead time that could have been spent trying to tackle the issues out on site. For example, a H&S advisor stated:

> *'We all spend time on the SOR, but I feel most sorry for her because she sits there all day and inputs most of them. It's a dull task and a complete waste of our resources. She would be better off spending time out on site for her and our benefit.'*

The SOR process had become a full-time administrative job. It involved: collecting the paper-based SORs into the system from all areas of the site; checking and re-categorising them as necessary; inputting them onto the system; chasing managers for unclosed or unresolved SORs; responding to complaints still awaiting a response to their SOR inputs; and replying formally to those who raised SORs as to their resolution. The administrative burden of this process was seen as a bureaucratic addition to the wider safety management system, with little relevant contribution to make in practice. This was not avoided on this project, despite the potential for 'data overload' to become a significant issue within any SOR system (Gnoni et al 2017).

The H&S team were also concerned about the sheer numbers of reports being lodged within these specific categories, as one H&S advisor commented:

> *'The worrying thing is, there are many of the SORs that keep getting repeated, and if something goes wrong, the HSE could use this big bank of data to just hit us over the head with.'*

For the H&S team, the repetition of SOR reports within these specific categories was felt to provide 'evidence' of a lack of effort on their part to action the findings of the SOR system, such data even seen as potentially damning in case of an incident on the site. This is reflective of the concerns raised by Van der Schaaf and Kanse (2004) who note that associations are readily made around blame or liability as a consequence of the collection of SOR data, specifically when systems are misused by others. However, within the dynamic and ever-changing construction site environment there are inevitably new issues created on a daily basis as access routes change, structures grow, and the actual business of construction is carried out. It would perhaps be more surprising if there was not some level of repetition within the SOR of these common safety issues. What is of more interest is the way the safety team felt about the creation of this vast database of evidence, and the way this negatively impacted on their own relationship with the SOR system. Perceptions of a blame culture seemed to exist between the H&S team and the higher project management and external H&S auditors, partly because of the way safety, or rather unsafety, was being measured and quantified within the SOR system.

The way the data output of the SOR system was being analysed was also problematic. The H&S team knew that the system was capturing the easily observable unsafe acts and conditions that they were themselves aware of and seeking to pro-actively address on the site, but was not able to reveal any more nuanced data or insights. This was problematic when considering what additional action they could or should take in response to the SOR outputs, as one safety advisor asked:

> *'Yeah, I agree, but what next? How can we use this data to change the negatives to positives?'*
>
> *(This question was met with silence in the meeting room)*

The SOR system was felt to fall short of any significant contribution to this 'what next' question. It was limited in its ability to reveal more hidden leadership or management issues (Fleming and Lardner 2002), and its continued focus on the same key issues that were already high on the H&S team's agenda was more disheartening than helpful. Hinze et al. (2013:28) explain that 'the critical question to ask is can safety professionals proactively address weakness in a safety process?' and within this SOR system, this did not seem to be the case. This was arguably because the SOR system was not being used within any wider framework, as found in more structured BBS or NMR systems. Not only would this have enabled the analysis of the data in more nuanced ways and created a more effective framework for action as a consequence of the data through goals, feedback or training, it would also have been able to influence the collection process itself through the more considered development of a SOR card than enabled more appropriate data collection that could better support more sophisticated analysis (Gnoni et al 2017).

Indeed, as Hollnagel (2011:6) states 'counting how often something happens is not learning. Knowing how many accidents have occurred, for instance, says nothing about why they have occurred, nor anything about the many situations when accidents did not occur. And without knowing why something happens, as well as knowing why it does not happen, it is impossible to pose effective ways to improve safety'. This manifested on the case study project, as despite the continued debates and discussions as the SOR reports were produced and reviewed by the team each fortnight, their ability to provide relevant or useful input to the H&S team strategy or practice was often questioned.

4.2.2 Quantity: Hitting the Targets

A contributory factor to the limitations of the SOR system was felt to be the motivation behind some of the SOR reports themselves. As one H&S advisor noted in a meeting:

> *'Moving to the SORs, a lot coming in which is good, but there were a few that were poorly completed again, and there was another bunch that are not worth the paper they are written on. I think some of the managers are trying to push numbers rather than quality.'*

Continued faith in the accident pyramid means managers often seek to increase their SOR reporting, with the idea that if these issues can be controlled then a major accident will not occur (Choudhry 2014). The SOR system provides the mechanism by which this can be achieved, and indeed measured; the volume of a team or section's contribution to the SOR process often seen as a clear demonstration of their commitment to safety. This was realised all too clearly on the case study project, as noted in Section 4.1 there was a significant spike in SOR numbers in March of 2013. At this time the interest in the SOR system by the client had cascaded down through the senior project management team to the section managers, and comparisons were being made between the different sections of the project. As a direct consequence of this, the section managers began to set informal targets for the number of SOR inputs to be made on their section each week and so numbers of reports rose. However, this is a clear manifestation of the problems targets can create within safety management (Sherratt 2016), as one H&S advisor explained:

> *'It's a way for them to say to the powers at be, "look, we are active with safety, we have X amount of SORs this month".'*

And as one worker noted wryly:

> *'SORs are used as a league table for some Managers, there's too much pressure on us to do them.'*

The quest for volume and targets may also have influenced the volume of SORs received within the same 'easily observable' categorisations, and the hazards most familiar to those working on sites. Yet if volume is not directly related to occurrence, and is instead driven by a desire to report no matter what the occurrences, then the SOR system itself becomes skewed. Although the number of SOR inputs was not a formal KPI on this project, it was informally used as such and was reported to senior management and the client every two weeks. Different departments across the project did not want to be seen to have only a low number of SOR inputs when compared to others, and so middle-management encouraged the volume of reporting and even set their own targets. The metrics started to gain more influence than actual practice, and on this site caused the H&S team to become more and more disillusioned with the value and utility of the data coming out of the SOR system, particularly as the sheer volume of data was also seen as direct evidence of their own poor performance.

The H&S team also challenged the authorship of the data at times:

'And again we are also not getting as many from guys out on the park…more at management level. '

Suggesting that the desired element of worker engagement was missing from the process. Worker engagement and involvement is critical for the success of SOR within a BBS or NMR system, and was perhaps limited on this project by the lack of any observer training given to support the SOR process (Cambraia et al 2010).

However, the findings here suggest that despite management actively engaging with the system, this was not in turn inspiring the workforce to also participate, as found by Cook and McSween (2000). Instead, the workers seemed to feel the system was not beneficial for safety management on site, because as this safety representative noted at a meeting:

'They are being quota driven by management, and by the way, numbers don't mean safety, but that's another story.'

If management were indeed seeking to meet quotas for input to the SOR system, this could further skew the outputs to the familiar and easily reported, rather than provide a true conduit for the workforce to raise specific or unique concerns. This also suggests that the management were perhaps using the system to shift their own responsibility for safety to the H&S team through the SOR system. One of the workforce felt this was a key issue:

'The problem with the SORs is they don't do anything…I mean, they just give guys an excuse to not intervene… they think because they have written it on a card that is safety.'

The site workforce questioned how the SOR system could ever improve safety on the site, drawing on the understanding that 'safety isn't an entity – something separated from work and practice and sat on its own in a folder on the shelf of a site cabin – but something we can create between ourselves on sites on a daily basis' (Sherratt, 2016:181). Although everyone on a construction site has clear duties with regard to health and safety under UK law, the SOR system does provide a mechanism for displacement, shifting the idea of safety into a formalised system which can then 'take care' of it. This also enables the management to feel they have contributed in some way to the safety management system, not least that they have demonstrated their pro-active attitude to safety in a tangible way. More fundamentally within the SOR system, the lack of effective worker feedback (Cooper 2009) may also have limited engagement with the system; as van der Schaaf and Kanse (2004:61) noted, if workers feel a system is useless and ineffective, they simply don't participate.

4.2.3 Name and shame and blame

Although the SOR system was initially established to create a communication channel for proactively raising safety issues, it also became a way to generate accusations and to channel blame. Indeed, 37% of the unsafe act SOR reports identified an individual either by name, the company they worked for, or by the registration number of their vehicle. For example:

> *'[company name] person stood above hand railing working on top of pier with no harness'*
>
> *'[company name] workers not wearing hard hats or gloves'*

The risk of SOR systems becoming conduits for blame is well recognised in the literature. For example, Gnoni et al (2017) state a no-blame culture is essential for the effective implementation of a NMR system, whilst van der Schaaf and Kanse (2004) note that risks of blame or liability should be carefully considered in the development of any SOR system, as well as acknowledging the potential for such a system to be misused and abused.

Within the SOR data, many easily observable behaviours of individuals were noted, many of which should ideally be challenged and resolved immediately by the observer themselves. Given the problems of SOR substituting actual action or intervention on the site, the H&S team were frustrated by the use of this system to report things that required immediate action to resolve, something the system could not support in practice.

Instead, the SOR system had developed into a recognised mechanism for individuals or companies to 'fire shots' at each other's safety practice, naming both individuals and organisations to ensure blame was duly appointed. Indeed, a member of the project's senior management team noted:

> *'They were more than blame, they were an attack.'*

The highly complex social, political and organisational issues that operate within the construction site hierarchy had seeped into the SOR process, and those who had helped create and enforce the policies were swiftly punished by others for any violation. Even where individuals were not named, the desire to lay blame was readily apparent:

> *'Safety rep parking vehicle in live traffic route to speak to his supervisor'*

> *'Security guard not using walkways, challenged and re-routed to walkway'*

That such reports specifically identify someone with a level of authority on the site further questions the motivations of those raising them; whether these are genuine attempts to improve safety and conditions on the site, or a co-opting of the SOR system to challenge those who have the authority to enforce rules and punish others, with the hope that some form of punishment for their own violations will follow. Indeed, the H&S team were often frustrated by the 'backstabbing' that they could trace through the SOR reports, between individuals and companies, which were simply adding volume to the SOR process, without bringing any benefit.

Furthermore, this indicates that the SOR system was being used within the scope of a *Person* approach to unsafe acts, inextricably linked to a blame culture (Reason 2008). The need to apportion blame within incident reporting has been previously identified by Whittingham (2004) and Dekker (2011), and so should not perhaps be surprising, however its impact in terms of the overall safety culture of the site was felt to be significant by the H&S team. As Meng (2012) explained, the creation of a no-blame (a just or open) culture is the first step to solving problems, therefore the contribution the SOR system was making to the emergence of a *Person* approach to safety, and the development of a blame culture was actually very damaging.

4.2.4 Trust in the system

A further negative impact of the SOR system on the site's safety culture was also evident in the way the system was viewed by the operatives themselves. For some, there was a lack of confidence that their management actually wanted the system to be used openly, and workers were worried about passing on negative SOR cards to their supervisors or managers, as this worker safety representative suggested:

> *'We need to bring in ballot boxes for SORs, because guys are afraid to hand SORs to their supervisor.'*

In positive safety cultures, such as a just or reporting cultures, employees can share safety information without fear or threat of punitive action (Reason 1998), yet this was not the case for all employees on this site. Fear of unemployment has been identified as a key contributor to under-reporting of safety issues (van der Schaaf and Kanse 2004; Probst 2006), and the H&S team were aware that this was a problem. This could have also contributed to the dominance of superficiality within the SOR, those asked to report seeking an option which would not implicate their own management in any safety violations, such as the lack of provision of safety equipment or time to carry out work safety, and instead focused on the easily observed behaviour of others, such as PPE.

This notion was also supported by the more sinister claim that some negative handwritten SOR cards were simply discarded by management and not entered into the SOR system at all, an informal 'vetting' process deciding what would be channelled to the H&S team and what would be censored. As one worker H&S representative noted:

> *'The SORs are vetted [by supervisors]. The real negative ones don't get raised. So what's the point in doing them if you can't do them honestly?'*

Despite reassurances from the H&S team that the SOR system was intended to provide a voice to the workforce, this was often met with disbelief, as another worker H&S representative noted:

> *'You are sometimes hard pushed to find your own one in the monthly SOR summary report. They must be vetted, the negative ones get chucked in the bin. I have looked to find some of mine. It took me a fair time as well because there are so many in the system. But yeah, I had a look for mine, and nothing. Had another look for another one. Nothing.'*

Such accusations are very serious, and unsurprisingly eventually lead to a breakdown of trust between the workers and the H&S team with regards to the validity and relevance of the SOR process. It also led to much more significant breakdowns of trust between the workforce and their immediate line management or supervision, who they felt were undermining their own ability to engage with health and safety on the site. Trust is critical to health safety management, as highlighted as one of the key eight factors from amongst the wealth of good health and safety practices at the Olympic Park project in London (Healey and Sugden 2012) which contributed to its health and safety success.

5. Conclusions

This paper has presented findings from a research project which saw the lead researcher become a member of the H&S team on a large UK construction site. The case study project was a large construction project, and considerable investment was made in its H&S management. As on many large construction sites, a SOR system had been established with the best of intentions by the H&S team, a familiar 'best practice' tool with which to gather safety data and also seek worker engagement as part of the wider SMS. However this did not produce the results they were expecting. This is a key finding of the study: implementing a 'stand-alone' SOR system without due consideration of what constitutes best practice can lead to unintended consequences. It is suggested that this finding has value for industry and for safety professionals.

To some extent, the SOR system would inevitably capture more of the easily observable safety violations on the site, so it is perhaps unsurprising that there was a constant number of SOR reports focused on just a few areas of poor safety practice. These are themselves identifiable as common industry safety problems, and so were also of no real surprise or utility to the H&S team, and indeed added little to their working day other than the need for administrative time in managing the vast database it created. That the H&S team were also unfamiliar with the underlying processes that should form the foundation of systems that mobilise SOR was also problematic. This would have enabled more effective data collection, more rigorous data interrogation, and enabled them to develop appropriate interventions, be that setting their own targets for corrective action or mobilise it in a goals and feedback approach with enhanced worker engagement in the process. Instead of providing robust safety knowledge, the SOR system instead became a tool which could be used to challenge their own performance. It told them what they already knew over and over again, repeatedly suggesting they were not acting sufficiently to control it, whilst making no real contributions in answering the critical question of *how* to bring about change.

This was further compounded by the desire of section managers on the project to achieve high volumes of SOR input, in part supported by the notion that this would somehow help prevent more serious incidents and demonstrate their own commitments to safety. Not only did this add significant volume to the SOR system, but it was often volume with little value, again focusing on the easily observable whilst neglecting more complicated issues. In the worst case, individuals chose to complete a SOR form rather than take the much more desirable immediate action to resolve a safety issue, the time delay before it reached the H&S team rendering it practically useless.

The SOR mechanism was also employed by some as a tool to blame others, individuals, organisations and those in authority. This also contributed to the development of a blame culture on the project as a whole, with some workers afraid to hand SOR cards to their managers, whilst other were convinced they were being censored, devaluing the SOR process as a whole. This environment of blame and fear of blame caused attrition in the trust between the workforce, management and the H&S team.

It is hoped this work is able to inform the future development and implementation of effective SOR systems. As the empirical findings have shown, careful consideration of the process is required before implementation. Their ability to defer intervention and shift responsibility for safety interventions, their ready associations with blame, and the potential for worker and H&S team disengagement from both the process and health and safety management in practice, must also be acknowledged. Indeed, it could be recommended that within the construction context, companies seek to identify key observable safety behaviours on sites without the implementation of current 'best practice' stand-alone SOR systems, as when considered holistically, there is actually the potential for them to do more harm than good.

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