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Occupant complacency in workplace fire evacuations

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This study explored occupant complacency during workplace fire evacuations. It is targeted at those responsible for fire safety management and fire safety practitioners with a contribution to prevent or mitigate the risk of injury or death arising out of a delayed evacuation at work. It seeks to define occupant complacency during workplace fire evacuations, identify its antecedents and explore effective measures to mitigate or control the antecedents of occupant complacency during workplace fire evacuations. Research was conducted using a survey instrument by contacting safety, health and fire safety professionals globally through convenience sampling and several international safety, health and fire safety-related institutions. This included demographics of the respondents, the confirmation of a definition of complacency, and means of dealing with complacency as defined by the questionnaire including priority strategies. The research team then sought to identify the antecedents of occupant complacency during workplace fire evacuations using raw data from a previous study. This study addresses the hypothesis that if there is a clear definition of occupant complacency during workplace fire evacuations and control measures are developed, tested and implemented, the risks of injury and death related to occupant complacency during workplace fire evacuations could be prevented or mitigated. Analysis of survey findings clarified a number of key strategies to avoid evacuation complacency including but not limited to underscoring the importance of leadership involvement within a safety culture; training and education, awareness raising and communications to avoid occupant complacency during workplace fire evacuations; evacuation drills; procedures, and the role of fire wardens. Based on information from a published report that explored individual attitudes, perceptions and experiences as well as perceived vulnerability that shape antecedents of occupant complacency during workplace fire evacuations and individual behaviours when an evacuation alarm is initiated, the authors identified and filled a gap in the report, by suggesting a working definition of occupant complacency during workplace fire evacuations and control measures to prevent or mitigate this behaviour.

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Introduction

Workplace (ILO 2023a) fires have caused considerable death and injury around the world. During the last century a landmark workplace fire in New York City, the Triangle Shirtwaist Fire, became the stimulus that led to the National Fire Protection Association (NFPA) Life Safety Code (Grant 1993). The Kader Factory Fire, in 1993, in Thailand resulted in a large number of fatalities and injuries (Haines 2005; and International Confederation of Free Trade Unions, ND) provoking renewed interest in ensuring the life safety, as defined by NFPA 101 (2024), of workers and others in industrial occupancies. More recently. numerous fatal workplace fires occurred in factories ready-made garment industry in Asia (Wadud and Huda 2017). Death and injury caused by these and other fires are frequently linked to an occupant's inability to evacuate or failure to promptly evacuate when the occupants perceive an alarm (Le et al. 2022). This study will focus on the latter group of occupants and address occupant complacency in workplace fire evacuations (occupant complacency during workplace fire evacuations).

This paper will address the investigation into the hypothesis that "if occupant complacency during workplace fire evacuations is adequately defined and adequate control measures are developed and implemented, the risk of death or injury during fire evacuations can be prevented or mitigated". This paper is targeted at those responsible for fire safety at work with its main contribution being a new perspective on research that provides a clear definition of occupant complacency during workplace fire evacuations; its antecedents, its risks and control measures to eliminate or control these risks. It assesses four research questions: Is there a clear and adequate definition of occupant complacency during workplace fire evacuations? Are workers, upon perceiving an alarm, complacent in their decision and behaviour to immediately begin movement towards a safe location as described by Kinateder et al. (2015)? What are the behaviours and conditions that are antecedents to occupant complacency during workplace fire evacuations? And what are the strategies to prevent occupant complacency during workplace fire evacuations? It will define and confirm a working definition of occupant complacency during workplace fire evacuations and confirm what complacency means in this context, the evidence for its existence, and the impact it has on the outcome of a fire evacuation. This paper will also fill the research gap with regards to defining occupant complacency during workplace fire evacuations in the Report of the Institution of Occupational Safety and Health (IOSH) Fire Risk Management Group (FRMG) Report (FRMG 2023). It will also explore the usefulness of this construct, and what direction future work should take.

To accomplish this, a study was designed and a survey was implemented to address the research questions listed above along with a review, statistical analysis and evaluation of the original data from the FRMG (2023) which included an initial list of antecedents to complacency, and current evacuation practices but did not define occupant complacency during workplace fire evacuations.

As the term fire safety may have different definitions and scope, the study adopts the suggested definition by The International Fire Safety Standards: Common Principles (2020) that fire safety principles include preventing fire events and minimising their impact including prevention, detection and communication, occupant protection, containment and extinguishment. Within the scope of this study, fire safety includes fire prevention and fire protection.

Part of this study is addressing how fire safety is managed. An important concept is fire safety culture which is considered by some a subset of the concept of an organisation's safety culture (Galea et al. 2011). The term safety culture is attributed to the International Nuclear Safety Advisory Group (INSAG) (1986) Summary Report on the Post-Accident Review Meeting on the Chernobyl Accident. The INSAG (1991) stated that "Safety Culture has two major components: the framework determined by organizational policy and by managerial action; and the response of individuals in working within and benefiting by the framework". Hassanain et al. (2022) described behaviour-based fire safety practices for the workplace that include but are not limited to risk assessment, improving behavioural capacity, raising awareness and developing strong collaboration among those affected. Together with legislation and codes, this leads to a fire safety culture, as proposed by Tavares (2009) and further defined by Menhas (2020) as "the attitudes, beliefs, perceptions and values that employees share in relation to fire safety". Additionally, Ivanov et al. (2022) and Ivnaov and Chow (2023) reinforced the essential roles of fire safety management and fire safety culture.

Legal instruments such as legislation and regulations are often put into place to prevent or mitigate the risk of death or injury caused by fire. Provisions in many countries require employers to take measures that will allow for the rapid and successful evacuation of workers, contractors and visitors in the event of a fire. The International Labour Organisation (ILO) in its Occupational Safety and Health Convention (C155) stipulates that, "Employers shall be required to provide, where necessary, for measures to deal with emergencies and accidents…." (ILO 1981). Osácar et al. (2021) suggest, from a legislative/regulatory perspective, there are national and local differences in approaching fire safety regulations which include prescriptive regulations, systems-based regulations and performance-based regulations. Some nations such as the UK, have moved from a prescriptive to a risk-based approach for fire safety management in workplaces stipulating, "… that in the event of danger, it must be possible for persons to evacuate the premises as quickly and as safely as possible". It also notes that appropriate fire safety training of employees is a legal requirement and must be adapted to risks identified by risk assessment (UK Government 2005).

The timing of the growth of fire has a direct impact on evacuation. Spearpoint (2008) emphasised that "the time to clear a space of people must be less than the time for life-threatening conditions to develop within that space with an appropriate margin of safety". This is reinforced by the Confederation of Fire Protection Associations in Europe (2009) that clarified the term, Available Safe Egress Time (ASET), stating that "ASET time quantification involves the ignition of fire and its spreading. It is the calculated time between the ignition of a fire and the time at which 'tenability criteria' are exceeded because of smoke, toxic effluents and heat". Delays at these early stages could result in the Required Safe Egress Time (RSET) exceeding ASET (Kobes et al. 2010), as the occupant may need to react quickly to have enough time to evacuate safely. Figure 1 shows the time frame between detection and complete evacuation including both RSET and ASET. This figure also indicates pre-movement time which starts once the alarm is activated and goes on until occupants start to move towards designated exits. occupant complacency during workplace fire evacuations normally occurs during pre-movement time.

The ability to safely and effectively evacuate also very much depends on human factors (Kinsey et al. 2019). Kobes et al. (2010) suggested that human behaviour during a fire evacuation can influence the outcome of an event. In particular, the actions taken during the early stages of an emergency can affect the likelihood of survival, with building occupants often required to perceive the situation and respond appropriately and within a timely manner (Canter 1980). Donald and Canter (1992) studied

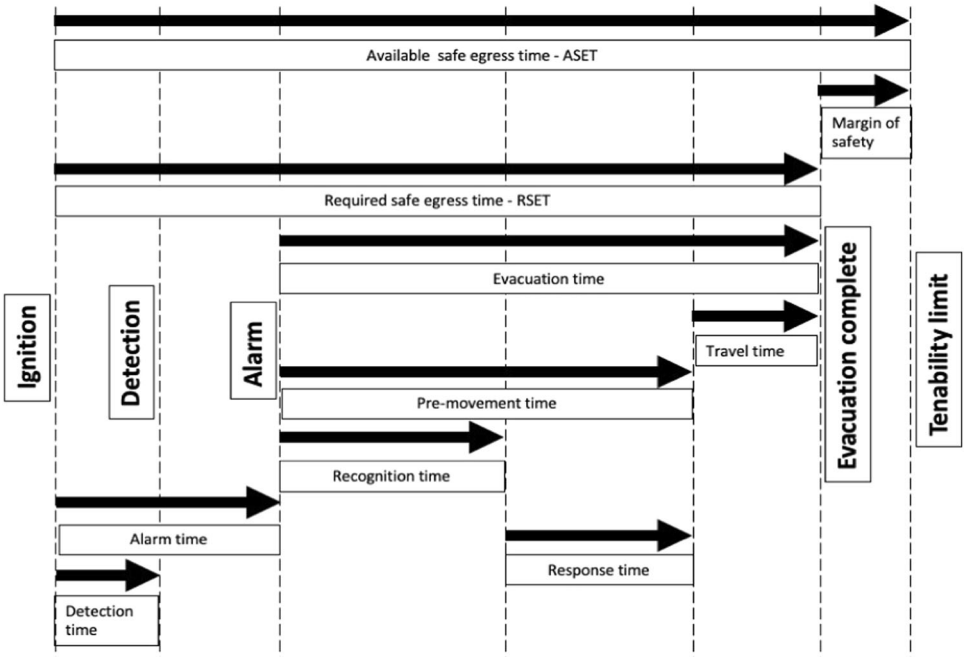

Fig. 1 The timeframe between ignition and complete evacuation. Taking into account various factors in the evacuation process, this diagram shows the Available safe egress time (ASET) and required safe egress time (RSET) timelines based on Proulx, G. (2008).

the behaviour of victims and survivors of the King's Cross Underground Fire indicating that social roles and place rules define scripts people follow, that people tend not to break scripts during an emergency and that people are generally weak in determining for themselves the nature, spread and growth of fire. Canter et al. (1980) suggested that occupant response in fire focused on interpretation, preparation and action. If a cue is not ignored, the main actions can include investigation, instruction, warning, firefighting, evacuation and waiting (e.g., not moving).

Kinateder et al. (2015) suggested that occupant risk perception (RP) is one determinant of evacuation behaviour in the early period of a fire emergency. According to Bernardes et al. (2015), there are actions associated with people's choices and behaviours. A low level of RP indicates a non-protective, cue-ignoring response. Key to the pre-evacuation period is the decision of occupants to evacuate after having received initial fire cues, which is potentially dependent on occupants' RP and other human factors. Kinateder et al. (2015) proposed that 'risk-as-a-feeling' and 'expectancy-value' are the two components of RP; and further suggests that, "RP is seen as the process of personalizing the risk related to the current event, such as an ongoing fire emergency. It is influenced by emotions and prone to cognitive biases". In moving from RP to action, both Wang et al. (2021) and Kuligowski (2009) suggested, with slight variation, that an evacuation timeline consists of four steps: perceiving of cues, interpreting the situation and the risk and making decisions about actions and carrying out action. Meacham (1999) added the importance of trained fire evacuation wardens to reduce delay in evacuation.

Gershon et al. (2007) conducted a qualitative study on the World Trade Centre Evacuation and found that individual factors, such as degree of familiarity with the building, preparedness training, perception of risk (formed largely by sensory cues), physical condition, health status, and footwear, all had an impact on evacuation. Leadership and group dynamics also have an impact on this (Table 1).

Lipinski (2021) associated RP with complacency, suggesting that complacency occurs when "the employee is not taking risks seriously and takes for granted that an accident won't happen to them". The Merriam-Webster Collegiate Dictionary (1999) defines complacency as "self-satisfaction especially when accompanied by unawareness of actual dangers or deficiencies". According to Årstad and Aven (2017), "Complacency is used to characterise an unawareness of the presence, the relevance and/or the importance of available information", who also stated that "evidence of danger existed but was not recognised adequately". Moray and Inagaki (2010) linked the need for monitoring behaviour to measure complacency. Despite numerous definitions and common use of the term, there is no common consensus on what it is (Parasuraman and Manzey 2010; Innes-Jones and Scandpower 2012). Innes-Jones and Scandpower (2012) claimed that complacency should be framed as RP and risk tolerance, given that the underlying psychological mechanisms of these concepts are better understood, and that the link between perceived risks and accidents is established. Bode and Codling (2019) suggested some insights into the need for staff to collect personal possessions such as phones, wallets and housekeys with van der Wal et al. (2021) identifying a trend in delayed response including collection of personal possessions, overcome when the alarm was accompanied by a pre-recorded announcement and filming when evacuating.

This paper also considers the influence of multiple people in the environment, specifically heuristic factors, such as familiarity, social proof, commitment and scarcity in decision-making in a work environment where invariably people will be with others (McCammon 2002). Groupthink is a phenomenon that can contribute to complacency. Forsyth (2020) defined this as a deterioration of judgement and rationality that can occur in highly adhesive groups.

It is recognised that certain industrial sectors carry a heightened risk of death or injury due to delayed evacuation, with literature pointing to reasons for delayed reaction to an evacuation alarm and potential consequences. For example, in the oil and gas sector, Deacon et al. (2010) described the consequences of delaying evacuation to a temporary safe refuge for a fire or explosion on an offshore oil site. In the chemicals sector, Johansson (2021) described the delays during pre-movement time

Table 1 Model constructs and predefined characteristics (WTC = World Trade Center).

Construct	Characteristics	Major Factor Category
Attitudes, perceptions of safety climate, perception of risk, fear	The individual's perceived risk to self, as well as his/her perception of his/her employer's commitment to safe work practices	Individual
Behavioural intentions	The behavioural intentions regarding evacuation	Individual
Beliefs	Belief in one's ability to determine the need for evacuating and belief in one's capability to do so	Individual
Evacuation behaviours	Specific actions taken by the individual evacuee regarding evacuation	Individual
Group behaviours	Collective behaviour of a group of individuals Individual and organisational	Individual and organisational factors
Individual factors	Specific characteristics of the individual that might affect evacuation	Individual
Knowledge	The individual's awareness and understanding of evacuation protocols and procedures, as well as possible means of egress from the building	Individual
Sensory Cues*	Cues in the environment (e.g., smoke, fire, noise, alarms) that served to make the individual aware of an event	Individual
Instinct*	Instinctive sense ("gut feeling") of danger	Individual

The asterisk (*) denotes factors added to the original model based on qualitative findings (after Gershon et al. 2007).

during an evacuation drill in a chemical company. Hulse et al. (2022) pointed out that construction workers may be reluctant to evacuate if there is any doubt that the threat is real. And in the coal mining sector, Bhattacharjee et al. (2020) described the delays in evacuation due to a lack of threat perception and a culture of denial.

Another important consideration, especially from a strategy of preventing occupant complacency during workplace fire evacuations is training, awareness raising and communications. Chu and Law (2019) found that people's perceptions of emergencies are influenced by their past and knowledge of pertinent fire situations. This, in turn, can result in a variety of individual behaviours during evacuation. The impact of a training session on employees' behaviour is crucial, as more fire drills are conducted, the more "progressively better behaviour of the workers during the fire drills" (Miguel et al. 2010). These authors concluded that more research was necessary to examine the connections between motivation and training, particularly whether improving behaviour directly affects evacuation time. Galea et al. (2019) proposed that training should emphasise the idea that 'every second counts' and help participants comprehend how rapidly an emergency scenario might worsen. Proulx (1999) stressed that to tackle complacency, effective communication needed to be included in employee training so that the occupants would promptly and effectively evacuate.

FRMG (2023) explored individual attitudes, perceptions, experiences and perceived vulnerability that shape antecedents of occupant complacency during workplace fire evacuations and individual behaviours when an evacuation alarm is initiated. Among the topics addressed, questions that examined these conditions and behaviours included: the occupants' perception of the level of fire safety within the occupancy; how much fire safety training (in years) had the occupant received; the level of concern about fire safety by the occupant's manager; how the occupant feels when the evacuation alarm is initiated; and action taken when the occupant is aware of an evacuation alarm. FRMG (2023) also explored the most effective cues to initiate an evacuation. It also identified that 96.5% of respondents could walk their primary escape route within three minutes and 76.0% could do so within two minutes. However, FRMG (2023) did not define occupant complacency during workplace fire evacuations; the reasons the occupant was complacent; or whether the occupant could adequately assess the risk of not evacuating when the evacuation alarm is activated.

Materials and Methods

The research team therefore sought to establish a definition of occupant complacency during workplace fire evacuations through a survey of professionals including chief fire officers and officials responsible for fire prevention; and better understand how effectively management strategies could lead to control measures in addressing the risks associated with occupant complacency during workplace fire evacuations. It also critically review the data from FRMG (2023) to identify relationships with factors considered as antecedents of occupant complacency during workplace fire evacuations.

After developing a research question and postulating a hypothesis, a review of the literature was conducted by the research team.

The research team conducted a literature review to determine if there was a clear definition of occupant complacency during workplace fire evacuations; antecedents to occupant complacency during workplace fire evacuations and control measures to prevent or mitigate the risks associated with occupant complacency during workplace fire evacuations. Included in the review was FRMG (2023). Building on the definition of complacency, from the literature cited above, a working definition of occupant complacency during workplace fire evacuations was drafted by the research team to be tested and validated by the survey. The draft definition was primarily related to the dynamics between individual factors and risk factors, with a view to test the notion that occupants believe that the perception or the lack of perception of risk/safety is the most common factor.

An eight-question survey instrument was assembled based on Lipinski (2021). Surveys used in this way gauge industry opinion on various issues (Afzal et al. 2023). This was to validate the definition of occupant complacency during workplace fire evacuations; examine conditions and behaviours that lead to occupant complacency during workplace fire evacuations; determine the frequency of occupant complacency during workplace fire evacuations; determine the urgency of addressing occupant complacency during workplace fire evacuations; and identify successful strategies and measures to either eliminate or mitigate the risks associated with occupant complacency during workplace fire evacuations. Questions regarding nationality were based on the United Nations List of Member States (UN 2024) and the choice of Industrial Sectors from the ILO list (2023b).

Once drafted, testing of the survey instrument was carried out with a small group of occupational safety and health (OSH) managers and workers in a chemical industry plant in Spain. These questions (abbreviated) can be found in Supplementary

Information Table SI1. After slight adjustments, the survey was finalised using the Qualtrics software (Carpenter et al. 2019) and mounted on the Qualtrics Web-based platform in March 2022.

The survey was opened for a one-month period in March 2022. To recruit participants and implement the survey instrument, the research team took a convenience sampling approach (Thomas, et al. 2018). The survey instrument was disseminated to participants globally on the Web, through LinkedIn social media accounts and through international OSH and fire safety-related institutions such as the Institution of Fire Engineers, the National Fire Protection Association (NFPA), and the IOSH FRMG covering a different demography than FRMG (2023). It included a broader representation of respondents outside the IOSH membership (which is primarily UK-based).

The research team examined FRMG (2023) and analysed its anonymised data set (which was the basis for the report) for comparative and statistical review. All aspects of the FRMG (2023) were designed to respect confidentiality of the interviewees by not identifying names of companies nor interviewees completing the survey in line with IOSH's ethical processes. The questions from FRMG (2023) were compared with the antecedents of the survey to establish the variables to be tested. Statistical comparison and testing were undertaken to look for any relationships between the identified variables.

The research team compared the antecedents to occupant complacency during workplace fire evacuations with the questions in FRMG (2023) identifying a number of questions that appeared to show similarity. Analysis was in two parts: firstly, identifying the antecedents for occupant complacency during workplace fire evacuations using the options given plus additional free text; and secondly, using SPSS, to compare the outputs that involved grouping responses for industry as close as possible to those in FRMG (2023). Comparison was between industry, country and whether their role had fire safety responsibilities (independent variables) with their success in strategies avoiding evacuation complacency and whether complacency plays a role in delaying an evacuation (dependent variables). In order to minimise the effects of low groups sizes with the software the research team looked to merge groupings where possible into similar groups.

A limited statistical analysis was undertaken using One Way Analysis of Variance (ANOVA) testing a null hypothesis criterion up to 95% with significance of .05 or less (a null hypothesis) for both pairs of variables. Responses were compared for factors identified as antecedents to complacency. ANOVA was chosen, as it is a commonly applied parametric test for checking differences between mean scores from three or more groups; it has an assumption that the population from which the sample was drawn is normally distributed (Ayarkwa et al. 2022). The test for null hypothesis was deemed statistically significant ($p < 0.05$). Homogeneity of Variance Tests were undertaken to establish whether equal variance could be assumed or not assumed. Where equal variance could not be assumed non-parametric, (significance below 0.05) the Dunnett T3 test was used to compare multiple comparisons. Where the Homogeneity of Variance Test was at or above 0.05 (parametric) the Bonferroni test was used. Responses were coded based upon the questionnaire as delivered, however recoding into smaller group sizes was required to reduce the number of low scores/zeros/intervals for options with low responses and to ignore the '*don't knows*' where appropriate.

Results

The survey results. These were collated, demographics of the respondents were documented; the definition of occupant complacency during workplace fire evacuations was confirmed; and conditions/behaviours leading to occupant complacency during workplace fire evacuations were documented. The frequency of occupant complacency during workplace fire evacuations; the urgency of addressing occupant complacency during workplace fire evacuations; and successful strategies to avoid occupant complacency during workplace fire evacuations were also gathered through the survey. The research team, having been given access to anonymised data from FRMG (2023), was also able to combine and compare the survey from this study with the above-mentioned anonymised data from FRMG (2023) to establish if the variables were associated with occupant complacency during workplace fire evacuations and where there could be some significance. The ANOVA results can be found in the Supplemental Information (see Supplementary Information Table SI2).

Demographics. A large number of OSH and fire safety professionals were contacted globally through LinkedIn and several international OSH and fire safety-related institutions including IOSH FRMG; the Institution of Fire Engineers and the (US) National Fire Protection Association (NFPA). One hundred and forty-six respondents from 29 countries completed all or part of the survey. Anonymity of the participants was assured through the process following GDPR (UK Information Commissioner's Office 2019) regulations, to maintain confidentiality. Table 2 describes and compares the number, location and industry of the Survey respondents.

Seventy-nine percent confirmed having responsibilities for fire safety arrangements with 16% stating they didn't with 5% giving no response. A full (non-combined) list of the location of respondents by countries can be found in the Supplementary Information Table SI3. A list of responses by industrial sector can be found in Supplementary Information Table SI4.

Table 2 The number, location and industry of the survey respondents.

		UK	USA	Rest of World	Total
What best describes the occupancy by Industry where your workers are working	Oil Gas/Chemicals/Mining	3	1	18	22
	Construction	8	1	12	21
	Education/Public Services/Fire Services	18	38	9	65
	Logistics/Retail/Transportation/Rail/Hotels/Catering	7	4	4	15
	Other	15	0	7	22
Total		51	44	50	145

Notes regarding Table 2 limitations:
- There was a need to combine industries with similar risk profiles into broader groups for statistical purposes due to limitations with regards SPSS.
- Sampling was carried out by convenience rather than by access to an unavailable broader organisational database.
- Access to a larger number of potential respondents across some industries and geographic regions was not available; the sample therefore reflected the authors' professional networks, particularly in the US and the UK.

Table 3 Summary of antecedents that lead to occupant complacency during workplace fire evacuations.

Antecedents from the survey	**Number or Responders**
Suggested antecedents in the survey	
Occupant(s) ensure(s) that others evacuate at the same time, rather than follow procedures	45
Occupants(s) feel(s) the building is safe and do(es) not feel the need to move	35
Occupant(s) do(es) not feel the risk is high enough to warrant evacuation	54
Occupant(s) is (are) apathetic	35
Additional antecedents summarized from the survey in free text	
Ignore Alarm / Cues to act	7
Inadequate training or awareness	2
Lack of knowledge regarding procedures / Lack of safety culture	4
False alarm or drill	5

Definition of occupant complacency during workplace fire evacuations. The first question was establishing a definition of evacuation complacency. The research team proposed the following, 'a delay in movement created during an evacuation when an individual occupant or a group of occupants do(es) not follow procedures when an evacuation alarm is activated'. All but one of the 145 respondents was able to observe conditions that led to occupant complacency during workplace fire evacuations with no contradictory comments.

Conditions (antecedents) that lead to occupant complacency during workplace fire evacuations. Respondents were asked, "What have you observed as the conditions that lead to evacuation complacency"? with four antecedents suggested and a free text option. The free text option led to the suggestion of 24 conditions being associated with occupant complacency during workplace fire evacuations. The research team was able to allocate six conditions of these 24 to the four antecedents suggested; and group the additional 18 into four additional categories (See Table 3). A full list of the original additional responses is summarised in the supplemental materials (See Table SI5).

Most respondents identified with the descriptors given with the predominant response from over one third that occupants do not recognise fire related risks related to the need to evacuate. Some responders indicated positive behaviours when the evacuation alarm was initiated including: "Generally good compliance with evacuation procedures within our premises"; "No issues in my workplace as a fire engineering practice we are fully aware of the importance of reducing pre-movement time when the fire alarm sounds"; "Occupants tend to evacuate almost immediately"; "Haven't observed this (complacency)" and "All generally follow procedures".

The Role of occupant complacency during workplace fire evacuations in delaying evacuation. The research team also examined responses to the question "On a scale of 1–10 with 1 being not at all and 10 being every time, how frequently at your facility does evacuation complacency play a role in delaying evacuation?" These responses were compared to the industrial sector where the workers were working (see Supplemental Information Fig. SI1). Analysis showed that not only respondents in sectors with higher fire risk, Oil Gas / Chemicals / Mining, but also those with higher regulation due to public facing aspects (Logistics, Rail, Hotel) indicated that they had successful strategies (7.8 and 7.4 respectively). Education/Public Services and Fire Services responders identified the lowest effect of complacency on evacuation at 3.95 with Construction the highest effect at 4.90. ANOVA Tests using SPSS indicated no significant relationships with $p > 0.05$ in all cases.

Success in the provision of strategies to avoid occupant complacency during workplace fire evacuations. The study also examined the responses to the question, 'On a scale of 1–10 with 1 being not at all and 10 being totally, how successful are you in providing strategies that avoid evacuation complacency in the space you are responsible for?' These responses also included the industrial sector where the workers were working See Fig. 2.

Table 4 compares the perception of how effective respondents in different industrial sectors feel their organisations are in both avoiding evacuation complacency (1 being not at all and 10 being every time), and whether it plays a role in delaying evacuation (1 being not at all and 10 being totally). The relationship between industrial sector and success in providing strategies that avoid occupant complacency during workplace fire evacuations in the space the respondent was responsible for was not statistically significant ($p > 0.052$). However, being so close to 0.05 the study suggests this is an area for further investigation with a larger sample with less grouping of industries.

Strategies to overcome occupant complacency during workplace fire evacuations. The survey asked respondents to list using free text in priority up to three strategies to avoid occupant complacency during workplace fire evacuations in their organisations (Table 5). The most popular responses were those around training, education, awareness training and communication (43%) followed by evacuation drills (21%) with only 12% stating evacuation plans, procedures and maps. This may suggest that workers do not actually read documents resulting in reliance on their acquired behaviours. Less than 8% believed that fire wardens (a role with varying duties) are a key factor with increasingly more flexible patterns of work.

Most of the factors stated in Table 5 need management resources and commitment including budget and access to expertise linked both to operations and facilities. Respondents were also asked to add any other comments or thoughts for the research team. Four responses were received, including: "A lot is taken for granted; people need to remember their safety is first a priority for them"; "All need to be educated about the speed of fire and how toxic smoke in modern fires is"; "There is a major problem with people disregarding fire alarms in the United States. While we can celebrate our successes, there are many fatalities"; and "If evacuation complacency exists in a workplace, it's indicative of weak management practices".

Analysis of data from FRMG (2023)

Demographics. The research team broke down the respondents with regard to both their level in the organisation and their industrial sector (Table 6). In all cases, the largest group was managers and, with the exception of Education, Public Services, Fire Services fewer workers and supervisors took part.

Table 7 shows the combination and comparison of behaviours and conditions reported in the survey with questions from FRMG (2023) as a first step to determine if there were statistically

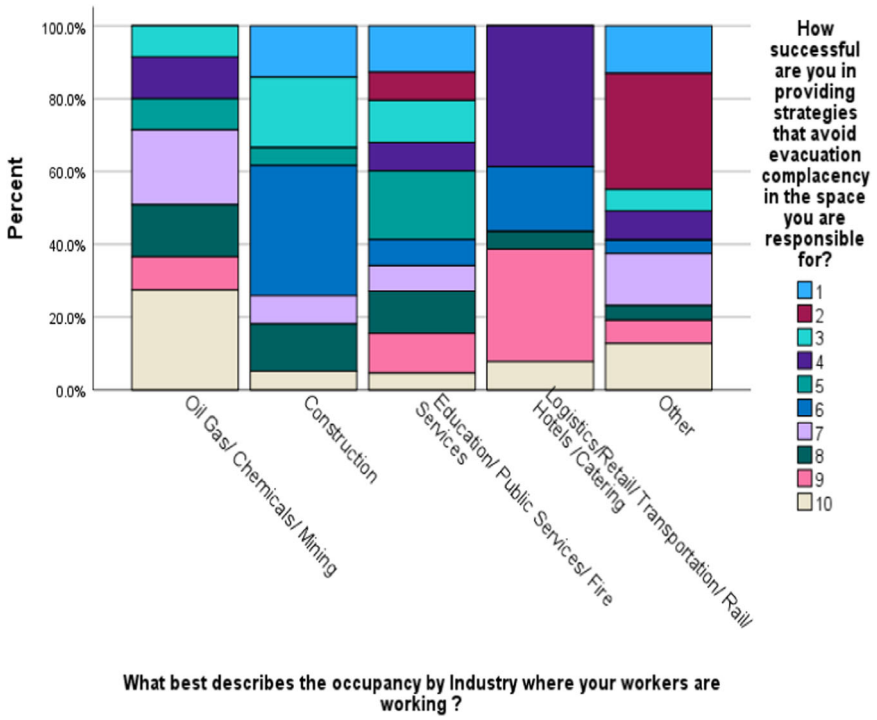

Fig. 2 Provisions to avoid occupant complacency during workplace fire evacuations. This figure compares the success of providing strategies that avoid OCWFE with the industrial sector.

Table 4 Cross-tabulation between Industrial Sector and Evacuation Complacency management strategies.

	How successful are you in providing strategies that avoid evacuation complacency in the space you are responsible for?			How frequently at your facility does evacuation complacency play a role in delaying evacuation?		
	n	Mean	Std. Deviation	*n*	Mean	Std. Deviation
Oil Gas/Chemicals/Mining	20	7.80	2.142	22	4.41	3.127
Construction	17	5.76	2.513	21	4.90	2.998
Education/Public Services/ Fire Services	55	5.95	2.670	61	3.95	2.765
Logistics/Retail/ Transportation/Rail/ Hotels/Catering	10	7.40	2.221	13	4.77	2.862
Other	19	6.05	3.440	21	5.10	3.064
Total	121	6.36	2.739	138	4.42	2.909

Table 5 Strategies to overcome occupant complacency during workplace fire evacuations.

	Classification	Top Priority	Second Priority	Third Priority	Total	%
1.	Training, education, awareness raising and communications	70	48	35	153	43.34
2.	Evacuation Drills	23	30	21	74	20.96
3.	Evacuation plans, procedures and maps	13	12	16	41	11.61
4.	Fire wardens	4	11	12	27	7.65
5.	Management role and policy	5	4	7	16	4.53
6.	Enforcement and disciplinary procedures	5	3	8	16	4.53
7.	Testing the fire alarm system	8	4	0	12	3.40
8.	Limiting nuisance alarms	5	3	1	9	2.55
9.	Safety culture	1	0	2	3	0.85
10.	Housekeeping	0	1	0	1	0.28
11.	Role of security	0	1	0	1	0.28
Total		134	117	102	353	100

significant relationships between the variables. When comparing the outputs with the questions used in FRMG (2023) (Table 7) five areas were identified that could be strengthened that could reduce the potential of occupant complacency during workplace fire evacuations and its associated risks to occupants during a fire evacuation. These areas are: the perception of management support concerning fire evacuation drills; frequency of and participation in fire safety training; perceived level of fire safety

Table 6 Summary of demographics of responses between industrial sector and role within the organisation.

Industrial Group	Worker/ Operator	Supervisor/ Line Manager	Manager	Director/ CEO/ Owner	Total
Chemicals, Oil and Gas	6	14	24	0	44
Construction	5	11	30	7	53
Energy, Engineering, Wastes' Management,	11	13	31	6	61
Education, Public Services, Fire Services	36	34	54	11	135
Logistics, Retail, Transportation, Rail	12	20	42	4	78
Other and not declared	3	5	29	5	42
Total	73	97	210	33	413

Table 7 Combination and comparison of behaviours and conditions reported in the survey with questions from FRMG (2023).

	Behaviours and conditions from Survey	Questions from FRMG (2023) that could influence complacency
1.	Occupant(s) ensure(s) that others evacuate at the same time, rather than follow procedures ($n = 45$)	- Your action when you are aware of an evacuation alarm - What is the level of concern of your manager?
2.	Occupants(s) feel(s) the building is safe and do(es) not feel the need to move ($n = 35$)	- Level of fire safety on your site - How do you feel when you hear the fire alarm?
3.	Occupant(s) do(es) not feel the risk is high enough to warrant evacuation ($n = 54$)	- Level of fire safety on your site - How do you feel when you hear the fire alarm?
4.	Occupant(s) is (are) apathetic ($n = 35$)	- How much fire safety training in three years? - What is level of concern of your manager? (Training is used to reinforce the importance and reduce apathy)
5.	Ignore Alarm / Cues to act ($n = 7$)	- How much fire safety training in three years? (Training will include the importance of understanding alarms)
6.	Inadequate Training or awareness ($n = 2$)	- How much fire safety training in three years? - What is level of concern of your manager?
7.	Lack of knowledge regarding procedures ($n = 4$)	- How much fire safety training in three years?
8.	False alarm or drill ($n = 5$)	- How do you feel when you hear the fire alarm? - What is level of concern of your manager?

on the work site; feeling of occupants when the evacuation alarm was perceived; and occupant action when the evacuation alarm was perceived. The research team was looking to demonstrate that some of the factors affecting evacuation are occupant complacency during workplace fire evacuations factors.

The level of concern of the company manager. The study examined the relationship between the number of hours of emergency evacuation training received over three years and the respondent's perception of concern and commitment of the company manager about fire drills. From Fig. 3, as the level of concern of the company manager about fire drills increases, the number of hours fire drills over three years also increases. This points to an increasing fire safety commitment and a strengthening of a fire safety culture within the organisation. The result using ANOVA was $p < 0.05$ indicating a statically significant relationship. Post Hoc Tests (Dunnett T3) revealed comparisons between all groups except '1 to less than 5 h' with '5–10 h' and '5–10 h' with 'more than 10 h'.

Evacuation training. Figure 4 shows the distribution of respondents by comparing the industrial group with the number of hours of emergency evacuation training over the past three years. It was identified that almost ten percent had no training at all. The sector with the least training was Energy, Engineering, Wastes Management. The sector with the most training was Chemicals, Oil and Gas, most probably due to requirements for training within the sector. The result using ANOVA was $p = < 0.05$ indicating a statistically significant relationship. Test of Homogeneity of Variance suggesting a parametric post hoc test (Bonferroni) however, indicated no specific correlation.

When the research team compared the statistical relationship between Age and the Amount of fire training received over the past 3 years, and Age and Industrial sectors, ANOVA indicated a normal relationship $p > 0.05$, indicating that there is no statistically significant difference in the group means.

The respondents' rating of fire safety on their worksite (Figs. 5, 6) reveals that although most participants felt fire safety was positive or very positive, ten percent felt it was weak or very weak. Figure 5 shows the relationship between how fire safety is rated and the number of hours of evacuation training received over the past three years. Those with the most training (five hours or more) were nearly double compared to those with less than five hours. Almost ten percent reported having received no training. The result using ANOVA was $p = 0.001$ indicating a statically significant relationship. Post Hoc Test (Dunnet T3) showed a difference between less than one hour with all other groups.

Figure 6 shows the relationship between how fire safety is rated compared with the industrial sector. The result using ANOVA was $p = 0.024$ indicating a statically significant relationship. Tests of Homogeneity of Variances suggested a parametric relationship with the Post Hoc Test (Bonferroni) suggesting significance between Construction with Logistics, Retail, Transportation (significance 0.029), Rail (and possible association Chemicals, Oil and Gas with construction (significance 0.064) with further investigations recommended.

Geographic location. The research team analysed the respondent's perception of the level of fire safety on the site with the grouped geographic location of the respondent. This geographic location, with different legislative requirements for workplace fire safety, is

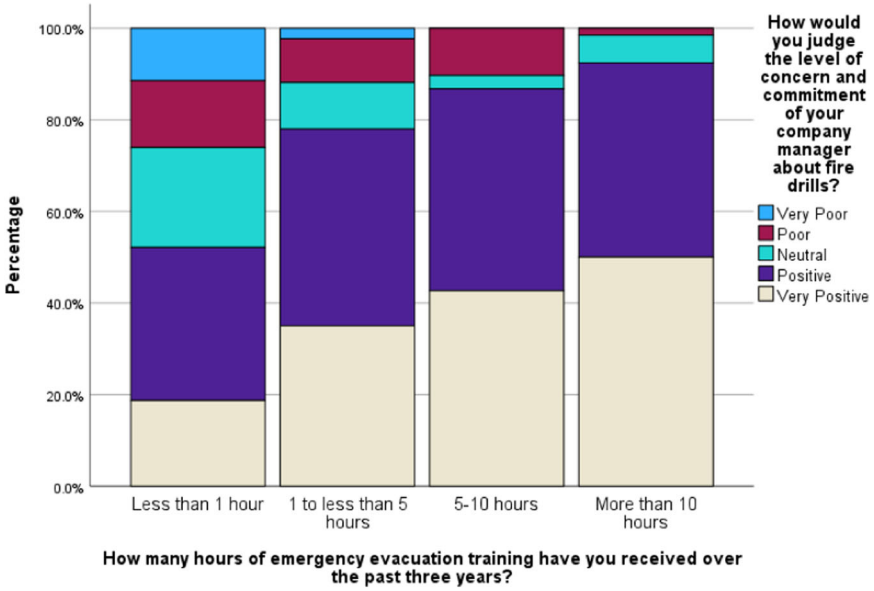

Fig. 3 Level of concern and commitment of the company manager. This figure compares the number of hours of evacuation training received over the past three years with how the respondent judged the level of concern and commitment of the company manager towards fire drills.

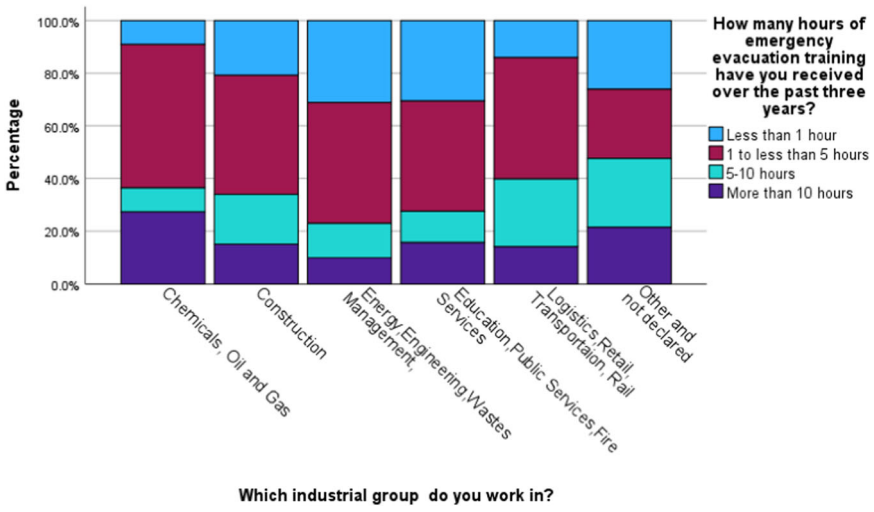

Fig. 4 Hours of evacuation training. This chart compares the number of hours of evacuation training received over the past three years with the industrial sector.

difficult to compare, for example, with fire safety requirements in the United Kingdom that has moved from a regulated approach to a risk-based approach. However, the result using ANOVA was $p = 0.003$ indicating a statically significant relationship. All respondents identified a fire safety culture (rating fire safety as strong or very strong). The study recommends that further research should be undertaken to examine this relationship for the rest of the world. Post Hoc Tec Dunnett T3) did not identify a particular relationship between respondents.

Feelings of occupants when the evacuation alarm was perceived. The survey compared two questions: when a fire alarm is activated, how do you feel; with what would you do when you hear or see an evacuation alarm at work. Figure 7 shows the analysis of the relationship between the two questions. This study suggests that the most compliant group would stop work and calmly leave without collecting possessions. The least compliant group relies on the instruction from the fire warden before evacuating. The compliant group would most likely carry out an effective, quick evacuation while the least compliant would be at higher risk during evacuation. The result using ANOVA was $p = 0.005$ indicating a statically significant relationship. The Post Hoc Test (Dunnett T3) revealed no specific relationships identified.

The research team also examined how the occupant felt when the fire alarm was perceived compared with the country the respondent was grouped in. Analysis revealed that the result using ANOVA ($p > 0.05$) were not statistically significant; possibly due to the broad categories used in the analysis and predominance of UK responses.

Figure 8 compares how the occupant felt when the fire alarm was perceived compared with the industrial sector. The result using ANOVA was $p = 0.051$ which although outside the tests outlined in this paper, suggests that more exploration is needed to develop people's initial feeling and whether / how this affects their speed of response.

A comparison was made between the age of the respondent with action taken when the occupant became aware of an evacuation alarm, after refining the data into similar-sized age

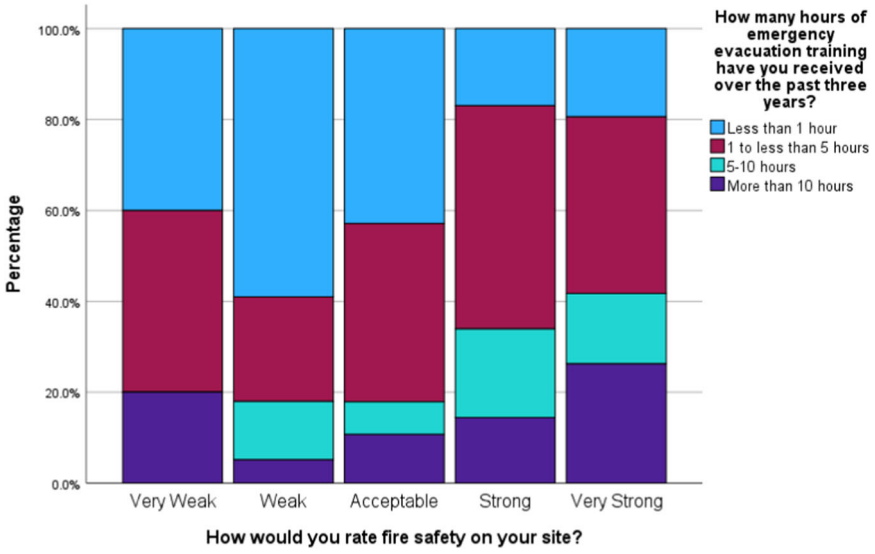

Fig. 5 Rating fire safety on the site. This chart compares the respondent's perception of the level of fire safety on the site with the hours of evacuation training received over the past three years.

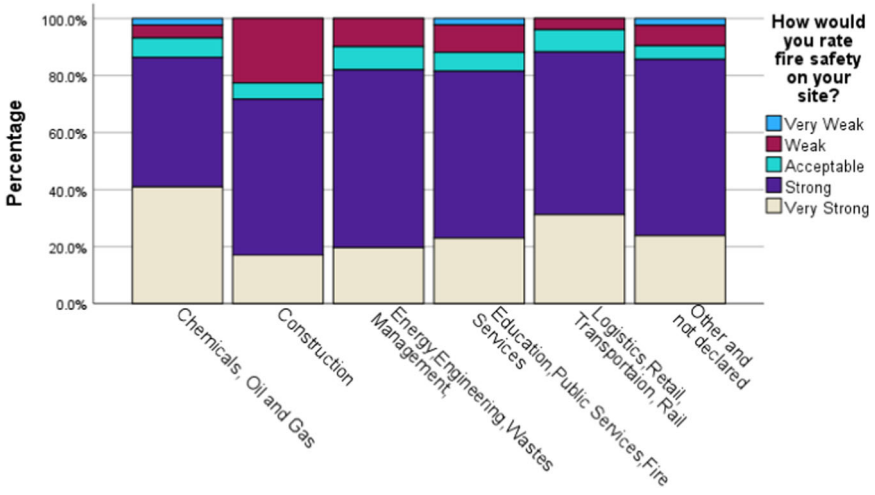

Fig. 6 Perception of fire safety. This chart compares the perception of fire safety with the industrial sector.

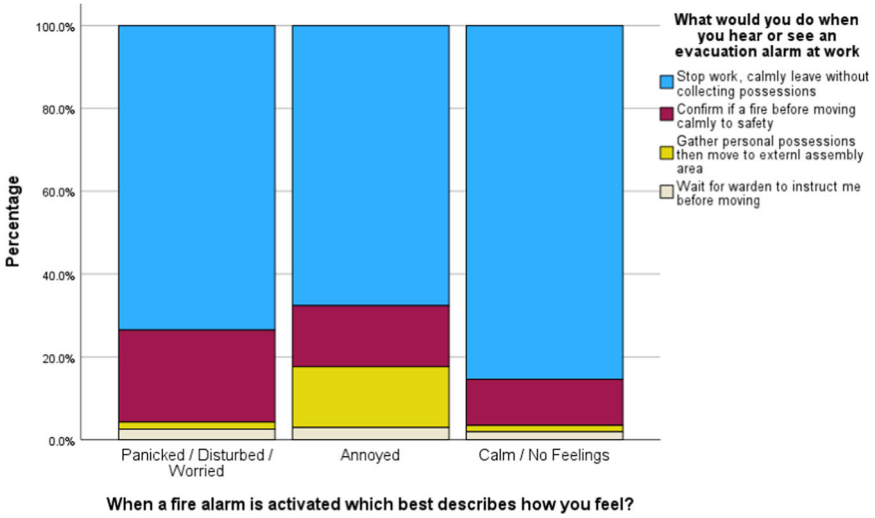

Fig. 7 Actions taken when the evacuation alarm is perceived. This chart compares how the occupant feels when the fire alarm is perceived with actions taken when the alarm is perceived.

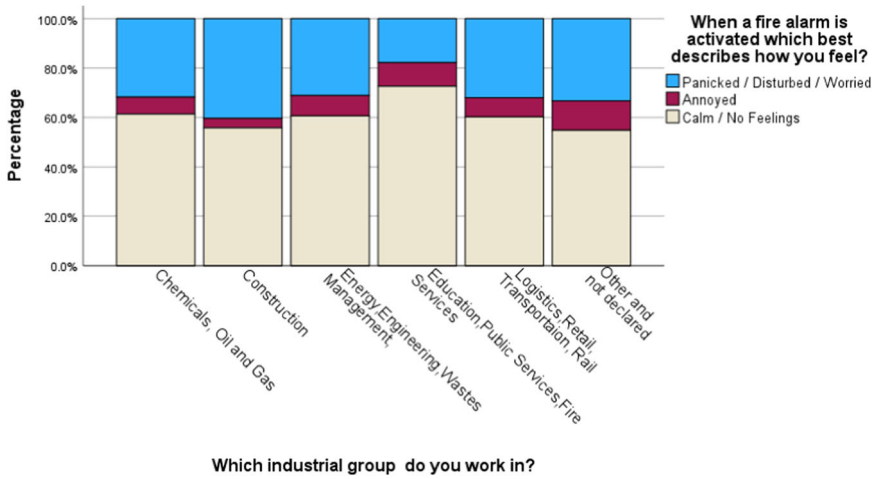

Fig. 8 How the occupant feels when the alarm is perceived. This chart compares how the occupant feels when the evacuation alarm was perceived with the respondent's industrial sector.

groups the research team carried out a statistical analysis showing that as occupants get older and more practice in fire safety procedures (possibly due to exposure through aggregated training) these occupants are more likely to evacuate on the first cue. ANOVA gave a result of $p = 0.031$, indicating a statically significant relationship ($p < 0.05$). Post Hoc Test (Dunnet T3) did not highlight any specific relationships (all tests $p > 0.05$) although Fig. 8 visually shows that those in the lower risk environment of Education/Public Service has the fewest people who panicked when the alarm is activated with construction workers often transient on a changing site by nature the fewest who remained calm.

Validation. A qualitative approach to minimise the effects of Construct, Content and Criterion validity was undertaken for both the survey and FRMG (2023) (Middleton 2019). Construct validity was designed out through thorough consultation, to ensure that questions were designed to measure what they were intended to do, with the survey aimed to complement FRMG (2023); the method of data collection was constructed to minimise incorrect interpretation of the question. This process was therefore foreseen to minimise the effects of content validity with fire safety professionals able to critique and influence the questions. Finally, for criterion validity the researchers discussed the findings with fire safety professionals to confirm that the results and findings were consistent with expectation.

The survey had a response rate of 95.2% for all but the question: 'How successful are you in providing strategies that avoid evacuation complacency in the space you are responsible for' which had a response rate of 93.7% once those without responsibilities were excluded. Imputation was discounted due to lack of interdependence of questions and was considered that this would create additional bias and lead to inaccurate results (Bhandari 2023).

Discussion

As previously stated, the aim of this study is to provide OSH and fire safety professionals with the concept of occupant complacency during workplace fire evacuations, its definition, its antecedents, and strategies for prevention. The study focused on the research questions addressing whether there is an adequate definition of occupant complacency during workplace fire evacuations; what the antecedents to occupant complacency during workplace fire evacuations are; whether workers are complacent in their decision and behaviour to begin movement towards a safe location as described by Kinateder et al. (2015); whether occupant complacency during workplace fire evacuations impedes successful evacuation; and what effective measures are there to mitigate or control the risks associated with occupant complacency during workplace fire evacuations. It addresses the hypothesis that if occupant complacency during workplace fire evacuations is adequately defined and adequate control measures are developed and implemented, the risk of death or injury during fire evacuations can be prevented or mitigated. The survey questionnaire used was not intended to develop a statistical representation of all OSH and fire safety professionals globally, but to provide a starting point to explore more in-depth the problem of occupant complacency during workplace fire evacuations with a view to finding additional strategies towards prevention and improving worker safety.

The research team identified conditions and behaviours that lead to, reinforced and sustained occupant complacency during workplace fire evacuations as well as strategies to prevent or mitigate occupant complacency during workplace fire evacuations (Tables 6, 7) and was, therefore, able to propose a definition of occupant complacency during workplace fire evacuations confirmed by the analysis of the survey as "a delay in movement created during an evacuation, when an individual occupant or a group of occupants do(es) not follow procedures when an evacuation alarm is activated". This definition satisfies a component of the research hypothesis and can serve as a springboard for other researchers examining behaviour during fire evacuation and workable cues to instigate immediate movement towards a point of safety.

The study's findings, within the scope of a fire safety culture (Menhas 2020; Travers 2009; Ivanov et al. 2022; and Ivanov and Chow 2023), validated the definition of occupant complacency during workplace fire evacuations and identified eight key behaviours or conditions that lead to occupant complacency during workplace fire evacuations, and strategies to prevent or mitigate the associated risks. The research team also validated the work of Lipinski (2021) by constructing, testing, and implementing a survey to address complacency during a fire evacuation and links the antecedents (conditions and behaviours) reported in the survey of occupant complacency during workplace fire evacuations (Table 7) that led to strategies to prevent or reduce these antecedents (Table 6). These strategies can be summarised under three headings that fall under the defined fire safety culture as defined by Menhas (2020) as: Management; Procedures; and Training (including evacuation drills and awareness raising).

The results reaffirmed that the increased management support, defined by the UK Government, (2005) as the responsible person(s), is linked to increased training (including regular evacuation drills) (Table 6 and Fig. 2), and continuous updating and reinforcing procedures. Regular training and awareness raising activities are the most successful strategies to prevent occupant complacency during workplace fire evacuations (Table 6) validating the work of Donald and Canter (1992) where occupants, without appropriate training, will continue to work in their normal way based upon their knowledge and experience; with the most effective mitigation measures being relevant training, education, awareness raising and communications. Our finding on training and evacuation drills (Table 6, Figs. 3–5) supports Miguel et al. (2010), suggesting the importance of management as a positive influence on workers behaviour during fire drills. When examining evacuation times, the study noted from FRMG (2023) that the time to walk the evacuation route, for the most part, was under three minutes. Therefore, consideration should be given to compare the time it takes to evacuate when the alarm is perceived with the time it takes to walk the evacuation route under normal conditions to quantify the 'time value' of complacency. This comparison can take into account different situations in different occupancies.

The research identified that some occupants did not want to interrupt their work to evacuate and there are people that did not follow procedures (Table 7) as identified by Hulse et al. (2022) and Rigos et al. (2019). This leads into the importance of identifying optimal behaviour to prove complacency (Moray and Inagaki 2010) which is impossible to achieve in many monitoring tasks, given the range of behaviours and conditions proposed in this study (Tables 4 and 7). It is suggested that optimal behaviour can be monitored during drills and actual fire emergency evacuations, potentially demonstrating the negative impact of occupant complacency during workplace fire evacuations, and this should allow for the development of interventions that could prevent or mitigate associated risks.

An important antecedent of occupant complacency during workplace fire evacuations is the reaction of the occupant when the evacuation alarm was perceived. This is consistent with Kuligowski's (2009) perspective on different reactions to the alarm (Fig. 7) suggesting that those who remain calm tend to follow procedures to evacuate and are not complacent. The definition of complacency (Hyten and Ludwig 2017) states that "… behavioural variation that eventually exceeds safety boundaries, manifesting itself especially with outcomes of explosions and fires". People who show concern occasionally need a second cue, and those who are annoyed often want to confirm that there is a reason to evacuate and want to gather possessions. These are factors related to occupant complacency during workplace fire evacuations.

The survey indicates apathy among occupants as well as waiting for additional cues before evacuation which may be an indication of a weak fire safety culture and weak leadership (Table 6 and Fig. 3) or the priority of their work. However, the results also confirm that the relationship between a perception of higher management support leads to a perception of higher levels of fire safety training, specifically evacuation drills (Figs. 3 and 5). This is an indication linking regular drills and training and education to management support which is an indication of a fire safety culture (Menhas 2020).

The study also confirms the importance of the organisation's leadership promoting clear and up-to-date procedures (Tables 4, 6 and 7) as a prevention and mitigation strategy linked to the fire safety culture and includes addressing immediate action when the evacuation alarm is perceived by the occupant. This strategy is critical to the prevention of occupant complacency during workplace fire evacuations. This confirms the importance of understanding of evacuation protocols and procedures as pointed out by Gershon et al. (2007) in their study of behaviours of the World Trade Center evacuation in 2001.

From an industrial sector perspective, comparison of how the respondent rated fire safety with the industrial sector showed the highest ratings in the Chemical, Oil and Gas Sector (Table 7) suggesting that in high-risk industries, as defined by Cornelissen et al. (2017) there is an increased awareness of fire safety. However, the Construction sector did not share that rating. This may be due to construction workers not considering themselves at risk from workplace fires.

The Survey supports the works of Deacon et al. (2010), Johansson (2021), Hulse et al. (2022) and Bhattacharjee et al. (2020) describing delays in emergency evacuation in high-risk industrial sectors. The study highlights that occupant complacency during workplace fire evacuations plays a role in delaying evacuation (Fig. 2) particularly in the Oil, Gas, Chemicals and Mining sectors as well as in the Construction Sector (Fig. 3), although the former sectors also have effective strategies to prevent or mitigate occupant complacency during workplace fire evacuations. However, a number of high-risk industries have successful strategies for managing fire emergencies which may reinforce control measures to prevent or mitigate occupant complacency during workplace fire evacuations and its associated risks such as:

1. Fire safety culture (Menhas 2020; Travers 2009; Ivanov et al. 2022; Ivanov and Chow 2023): High-risk industries tend to have in place a fire safety culture that includes engaged leadership and all levels of management and workers;
2. Procedures (Gershon et al. 2007): Participation of management and workers in building directives and procedures; and a well thought out emergency response plan that is developed in concert with local fire authorities. The procedures would also include the role and limitations of a trained internal fire brigade, rescue teams and evacuation wardens;
3. Training (Deacon et al. 2010; Miguel et al. 2010): The provision of fire safety training (both at induction as well as periodic training activities), and periodic fire safety awareness-raising programmes reduces the potential for occupant complacency during workplace fire evacuations.

A theme that emerged from the Survey and FRMG (2023) was the challenge created by an excess of false and nuisance alarms. Although not addressed in this paper, provisions should be made to provide advanced detection and alarm systems that include voice notification, as well as maintenance of fire alarm equipment. This can lead to frustration and anger with our findings supporting the work of Bode and Codling (2019) and van der Wal et al. (2021), with a relationship between when workers are annoyed and waiting to collect personal possessions before evacuating.

The study reaffirmed the importance of worker/management involvement in building and sustaining fire safety. This included the imperative to provide workers with the basic knowledge about fire safety, strengthening and reinforcing awareness and drilling and evaluating evacuation procedures. This study demonstrated that when there was strong support of fire drills by senior management and the presence of effective fire wardens during the pre-movement phase of an evacuation, occupants would begin evacuation when the evacuation alarm is perceived (Meacham 1999). Figure 7 suggests that some employees wait to be instructed to leave by a fire warden, yet the study identified a statistically significant relationship on the presence of fire wardens. This

indicates that the presence of fire wardens is often passive but vital. The study reinforced the importance of cues during the pre-movement phase of evacuation (Fig. 7) supporting the work of McCammon (2002), Gershon et al. (2007), Bernardes et al. (2015), Kinsey et al. (2019), and Wang et al. (2021).

Conclusions and recommendations

This study, addressing the research questions as stated in the Introduction and the Materials and Methods sections, is the first research paper to put forward and validate a definition of occupant complacency during workplace fire evacuations, expand on behaviours and conditions (antecedents) that lead to occupant complacency during workplace fire evacuations, and strategies to prevent or mitigate it and its associated risks. The research highlighted the importance of leadership and engagement as aspects of a fire safety culture which foster positive and protective attitudes, perceptions and knowledge that promote appropriate and safe behaviour during the pre-movement phase of a fire evacuation.

This investigation recognised that previous studies focused on risk perception as part of human behaviour that motivates or inhibits occupants to take immediate action when the evacuation alarm is perceived. However, within the scope of this work, it was found that appropriately developed and tested procedures, supported by an organisation's leadership and continually reinforced by awareness-raising activities, training and regular fire drills, can strongly contribute to a mindset for occupants to begin moving when the alarm is perceived. Moreover, from a training and exercising perspective, the research supported the notion that fire safety training needs to be related to the risk. The authors are concerned that if training and awareness appears unaligned with the risks, continuous training to reduce occupant complacency during workplace fire evacuations may impede the development of positive behaviours over time. There is also the issue of the questions, "whether the occupant feels the building is safe and does not feel the need to move", and whether "the occupant may not feel the risk is high enough to warrant evacuation", suggesting that occupants may over-estimate their own safety and choose to remain, whereas if occupants felt relatively unsafe, there may have been motivation to evacuate sooner. More research is needed in this area. The role, or presence, of the fire warden to reinforce the immediacy of this action was also identified.

This research demonstrated that in certain high-risk industrial sectors, such as the oil and gas industry and the construction sector, despite complacency being identified the risk of complacency during a fire evacuation was managed more effectively, therefore occupant complacency during workplace fire evacuations may have had an inverse relationship with increased workplace fire risk. The challenge for the construction industry may be the variety of activities within its industrial sector, an international / migrant / multi-lingual workforce, as well as much work being sub-contracted out to other employers.

This research confirmed the presence of occupant complacency during workplace fire evacuations as a factor in the delay period during the pre-movement phase of evacuation (between the receipt of the alarm and the commencement of movement). When organisations manage occupant complacency during workplace fire evacuations, the risk of death during evacuation can be reduced. However, globally, across all industries, more effort must be made to strengthen the knowledge, attitude and skills related to preventing occupant complacency during workplace fire evacuations to reduce the possibility of its occurrence. When considering FRMG (2023), most evacuation appears to be under three minutes suggesting a value that organisations should strive for, with this study proposing a method to measure the timing of complacency. Additionally, the definition of occupant complacency during workplace fire evacuations should be further tested in future studies and in a variety of contexts. The study also recommends that to reduce delays, it is suggested that wherever possible occupants should keep items such as personal electronic devices (such as cell phones) and keys in their possession because the personal significant value may lead to a reluctance to evacuate without these items. Finally, this research also supported the notion that occupant complacency during workplace fire evacuations should always be a consideration in both fire risk assessments and fire investigation.

Study limitations. Although the research team used professional contacts through LinkedIn, the IOSH FRMG, and other fire institutions participating in this study, future studies may wish to consider casting a wider net to embrace a larger cohort including more of the developing world, more industrial sectors and other language groups (to avoid possible linguistic bias). Future studies may also wish to establish a broader and more diverse survey population with a view to understanding the worker perspective and associated behaviours.

National authorities may wish to consider legislation or codes of practice that develop, within risk assessments, how evacuation is dealt with during the pre-movement phase and what control measures could be considered. Legislation may also take into account the different occupancies and how evacuation is managed.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Author contributions

The above-listed authors contributed equally to this work.

Competing interests
The authors declare no competing interests.

Ethical approval
All four authors worked on this study as independent researchers. Although none of the four authors were working under the auspices of any research institution, the research team undertook an ethical screening process, that identified that the ethical risks were low risk in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study inquired about existing practices relating to complacency during a fire evacuation and no bio-medical studies were conducted by any of the authors. This study does not contain any studies with human participants performed by the authors and therefore was performed in line with the principles of the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent
The Survey did not seek the identification of the respondents' nor the organisations' identity, and was totally voluntary. The individual respondent could choose whether to participate or not and was informed that "an international research team is working to contribute to fire safety by documenting complacency during a fire evacuation". "This is an anonymous survey. We would appreciate it if you could take ten minutes to complete the survey online by clicking on a dedicated link". It was also explained that measures were in place to ensure the confidentiality of this data. The individual taking the survey therefore chose whether to participate or not. This study does not contain any studies with human participants performed by the authors, therefore, informed consent was not relevant to this study or this paper.

Additional information
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