

HUMAN FACTOR PERSPECTIVE OF THE PUTRA HEIGHTS GAS PIPELINE EXPLOSION

The recent gas pipeline explosion that shocked Putra Heights has opened up extensive discussions among industry practitioners and academics. While much of the conversation has focused on technical aspects such as pipeline system design, excavation work specifications near pipeline corridors, and technical safety procedures, there is one critical component that often remains behind the scenes – the human factor. To understand this incident comprehensively, we need to look more deeply at the human elements that influenced the event.

Accident investigations are still actively being conducted, and it is hoped that the findings will provide a complete picture of the main causes and the most effective measures to prevent such incidents from recurring. This article aims to provide a "Human Factor" perspective on industrial accident. In industrial accident investigation procedures, the human factor is one of the main elements examined. Its purpose is not to find fault but to identify the causes that led to errors.

As an academic and human factors professional, I believe this incident is not merely a technical failure, but the result of systemic failures that involve human elements, either directly or indirectly. This approach opens up space for a deeper understanding of how humans interact with systems, subsequently affecting operational safety.

Understanding the Basics of Human Factors

Human factors is a discipline that studies the interaction between humans and systems, technology, and their work environment. In the context of the gas and energy industry, this encompasses various elements such as cognitive abilities, physical limitations, the influence of fatigue, work pressure, communication, training, and organisational culture. This statement provides the basis for understanding that when systems are designed without considering human characteristics, or when work processes do not support safe behaviour, the risk of failure increases significantly. Thus, the discussion of human factors provides a foundation to explore further the causes of failure that occurred.

Human Error: Characteristics and Classification

Human error often becomes the focus in incidents like this. However, it's important to understand that errors don't solely originate from individuals but can be classified according to their context. Human Error Classification according to Reason 1990 can be broken down into three categories: 1) Slips and lapses, 2) Mistakes, and 3) Violations. Slips and lapses are unintentional errors due to distraction or fatigue, for example, when a contractor fails to identify an early gas leak. In the Putra Heights case, if leakage occurred earlier, were these early signs overlooked by supervisors and workers? Next, mistakes refer to incorrect decisions due to lack of information or training. For instance, contractors carrying out earthworks might not understand the exact location of the pipeline despite being provided with plans; might this be due to insufficient instructions or briefings? Finally, violations refer to breaches of rules, either intentionally or due to a work culture that normalises risk (risk normalisation), such as excavation work without full permission or without checking underground utility plans, or deliberately disregarding basic safety requirements. This explanation of human error provides the basis for understanding how individual failures are actually closely related to systemic weaknesses.

The Role of Latent Failures as Prerequisites to Incidents

Following the discussion on individual errors, it's important to see that human failures rarely occur in isolation. In many cases, they are influenced by what are known as latent failures – hidden failures in the organisational system that have existed for a long time but only become triggers when combined with frontline human actions. Lack of information, instructions, standards, level of operational safety, and training among contracted contractors may not be an individual mistake but stems from an organisational culture that does not provide a comprehensive safety orientation programme for work near gas pipelines. This includes failure to communicate procedures, guidelines, and standards that state specific requirements, including no-entry buffer zones and "permit-to-work" procedures for any excavation work near gas pipelines.

Furthermore, latent failures also encompass aspects such as tight work schedule pressures, lack of supervisory staff on site, and ineffective safety audit systems. This causes frontline workers to be exposed to the risk of making decisions based on incomplete or inaccurate information, or forced to prioritise productivity over safety to meet work schedules or management directives. In this context, high-risk decisions such as carrying out excavation work near a gas pipeline without thorough checks are not actions without any reason, but reactions to the existing system.

Therefore, in investigating the causes of incidents such as the Putra Heights gas pipeline explosion, attention should not only be given to individual actions on site. Instead, the analysis should be directed at organisational decisions at higher levels: how were contractors selected? Were they screened for technical capabilities and safety compliance? Was there an effective risk monitoring and communication system between the principal, main contractors, and sub-contractors? By understanding and identifying latent failures, we can build prevention systems that are not merely reactive to human errors but proactive in identifying and closing systemic gaps before incidents occur.

The Role of Organisational Culture and Leadership

Taking into account latent failure factors, organisational culture and leadership play a crucial role in determining the operational safety of an organisation. Organisational culture reflects the values, beliefs, and practices shared by all staff, and it has a direct influence on how employees make decisions in the field. When organisations place too much emphasis on achieving physical KPIs such as completing work earlier, maximising profits, or reducing operational costs without giving balanced attention to compliance with safety procedures, then violations of rules will become an accepted norm.

This phenomenon is known as risk normalisation, a condition where risky behaviours that should be considered unusual or dangerous become routine, no longer questioned, and eventually accepted as daily norms. More worryingly, these practices are sometimes indirectly rewarded, for example, when work done without formal procedures is still praised for saving time or costs. Over time, workers and supervisors will be more inclined to take shortcuts because they are seen as more productive, even though they quietly risk safety. In the Putra Heights case, there is a possibility that the work culture of the organisation and contractors has created an environment that allowed earthworks to be carried out despite the risk of disturbing underground pipes. If leadership does not set strict safety standards, such as mandating technical checks before digging, or enforcing permit-to-work procedures with high discipline, then the signal received by workers is that safety compliance is optional, not a priority. Moreover, an organisational culture that is not responsive to public hazard reports or worker concerns also contributes to the fragility of the safety system. If workers feel their voices are not heard, or safety complaints are considered as work delays, they tend to remain silent. Leadership plays an important role in shaping this culture. It's not just through policies and directives, but also through examples of daily behaviour. Leaders who go to the ground, pay consistent attention to safety, and encourage open reporting without punishment, will build a healthy and resilient work culture.

This discussion on organisational culture relates back to individual errors and latent failures, showing that failures in safety management are not only rooted in technical or operational aspects but are deeper, caused by values, priorities, and work practices that are allowed, tolerated, or left to develop within the organisation. In this regard, any change to the level of safety must begin with a change in culture and leadership.

Making Safety an Organisational Responsibility, Not Just Individual

Failures involving humans should not be viewed solely through the lens of the individual. Organisations need to shift from an approach that blames individuals to one that understands that poor performance is often the result of systems that fail to support workers. In other words, the question that should be asked is not just "who is at fault", but "what in this system allowed the error to occur?" and "how can we prevent it from recurring?"

The approach of blaming individuals often only produces cosmetic solutions. For instance, by suspending contractor licences, imposing penalties on workers, or introducing retraining without addressing the root of the main issue. Instead, the true responsibility for safety should rest on the shoulders of organisations that design work

systems, manage critical information, set training standards, and shape daily work culture. This includes ensuring there are two-way communication channels between management and the frontline, creating a work environment that supports early risk reporting, and allocating time and resources for work to be done safely. For example, if workers perform excavation work without checking underground utility plans, is that error solely due to individual negligence? Or does it reflect a system weakness that does not provide easy access to such plans, fails to give specific briefings related to gas pipeline risks, or lacks enforcement of work permit requirements? In such situations, individual errors are merely 'symptoms' of larger system failures.

Safety cannot be manifested in the goodwill of individuals alone. It must be driven by systems that support, encourage, and reinforce safe behaviour at every level of the organisation. This approach is not only more accurate but also more effective in preventing tragedy. So, the change we need is a cultural shift; from finding who to blame, to building systems that do not allow those mistakes to happen in the first place. Overall, the gas pipeline explosion in Putra Heights is not just a tragedy, but also a call to reassess the industrial safety management system comprehensively. While technical aspects remain important, human factors cannot be ignored. Modern safety management should be based on the understanding that humans, organisations, and technology are interdependent entities. Only through a systemic approach and the integration of human factors knowledge into every level of operation and risk management can we prevent similar incidents from recurring in the future.

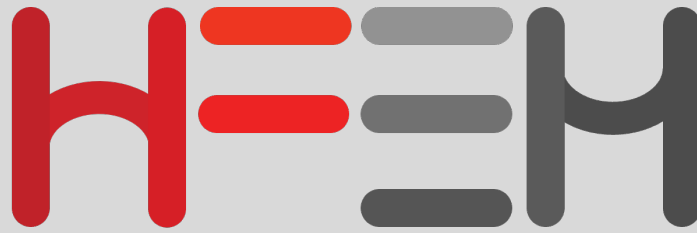
The gas pipeline explosion in Putra Heights is a harsh reminder that our industry still fails to understand a basic truth: technical problems never occur on their own without involving human actions or decisions. This tragedy is not just an engineering problem, but a manifestation of deeper systemic failures.

As long as we continue to ignore human factors and separate them from safety system design, protocol, management and decision making, we are actually laying the groundwork for the next disaster. It challenges us to question: What use are sophisticated safety procedures if our work culture silently normalises risk? The approach of blaming individuals is merely a sedative that protects the actual weaknesses of the organisation.

The Putra Heights tragedy calls for a revolution, not evolution, in the way we interpret industrial safety. We need to shift from asking "Who is at fault?" to "What in this system allowed this to happen?" Only through the integration of human factors knowledge into every level of operation can we break this recurring cycle of tragedy. This is not an option, but a moral and professional necessity that can no longer be compromised.

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