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Article

Accident Report Interpretation: The Power of Language

Derek Heraghty [1], Sidney Dekker [2] and Andrew Rae [2,*]

[1] Griffith University, School of Humanities; derek.heraghty@griffithuni.edu.au
[2] Griffith University, School of Humanities; s.dekker@griffith.edu.au
* Griffith University, School of Humanities: d.rae@griffith.edu.au; Tel.: +61 7 3735 9764

Abstract: The language we use to describe the past can have a strong influence on the audience's interpretation of our story. In our experiment, we explore, using 3 different conditions, how the framing and language of an accident report can affect the audience's proposed solutions to manage the problems found. We find that the approach used to create an accident report can have a powerful influence on the audience's decision making. Whether we are describing an accident in a similar manner to a crime, using a systems approach or we are accepting of multiple stories which are not linear or coherent, the methods we use to capture and communicate the story have a profound impact on the actions decided upon by the reader.

Keywords: accident, investigation, punishment, language, multiple stories, crime, framing, human error, systems thinking, actions.

1. Introduction

How stories are framed can greatly influence the readers' interpretation of the event and the actions taken as a result. The analysis of accidents provides a prime example of this.

The power of language and metaphors is showcased in the work of [1]. In their study, Thibodeau and Borodtisky presented participants with different descriptions of the same fictional city suffering from a surge in crime. Their study sought to understand how metaphors shape understanding and reasoning, and whether the use of different metaphors to describe crime would lead to the proposal of different solutions. Their study's results showed that when the word "beast" was used to describe crime, the proposed solutions were much more likely to be enforcement based, while when the word "virus" was used to describe crime, the proposed solutions became much more social-reform based.

The influence of the English language on our thoughts and actions, as opposed to other languages, should not be understated either. In the description of accidents, the English language consistently uses the agent of causality to describe the event e.g. "John dropped the vase". Conversely, when describing accidents in Spanish or Japanese, the agent of causality is dropped, "The vase broke itself" [2]. This showcases how those of us who speak the English language are more likely to naturally focus upon human error because of our instinctive way of describing the world we see. When this is refined to how we normally hear about accidents, which is usually in a headline format to keep it sharp and simple, the accident becomes more about the individual than about the system issues which have led to it occurring due to how we describe the event.

In this paper, we empirically analyse whether using different metaphors and writing styles to describe an accident leads the reader to focus on different aspects of the report and to propose different solutions. Will the solutions vary in line with the writing style? Will the metaphors used encourage people to reason about the event in a consistent manner with the underlying perception of these metaphors? For example, if we use language which is consistent with how law enforcement describes a crime, will people treat the event in a similar manner to how crime is dealt with in society? Or if the event is told in a way which is aimed towards a learning outcome, will the solutions proposed be consistent with the aims of the storyteller?

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2. Materials and Methods

2.1. Participants

For this experiment, we used a sample population of 93 people, all of whom work for construction companies. The study was issued to the operational staff members of three different companies and the studies were issued in alphabetical order using each organisation's distribution list. Our sample population included various sub-populations such as engineers, construction managers, human capital personnel and safety advisors. This allowed us to sample a broad cross section of the production support team. This was necessary as people's conceptions of workplace accidents may differ depending on their past experiences, their role and their exposure to the accident process.

The data was collected using both paper and online anonymous surveys and there was no incentive to participate.

2.2. Materials

The experiment involved 3 conditions. Each participant was randomly allocated one of three accident reports, such that each report was reviewed by one third (31) of the participants. In each of the three reports, participants were presented with a description of an event which had the potential to cause life-altering harm to human life. Each report described the same event. The reports differed in their language, structure and focus. Report Variant 1 focussed on human error, Report Variant 2 focussed on issues existing within the organisation's system, and Report Variant 3 focussed on the provision of multiple accounts.

Each report information sheet requested the participants to "review an accident report and provide 3 recommendations based on the information provided". The heading above the 3 blank boxes provided asked the participant to "identify preventative/ corrective actions".

Participants could access the report and submit their response in either paper or electronic format.

2.3. Conditions

2.3.1. Condition 1

The search for human error following an accident has long been a goal of many accident analysers. One of the factors which greatly increased the focus on human error following an accident was the event which occurred at Three Mile Island and the use of the label "human error" in the subsequent report [3].

The spotlight on human error within the world of accident analysis intensified in recent decades because of human error focussed research, such as that of Stanton and Glendon's work on individual attitudes to risk taking [4]. This led those within the field of accident analysis to place a disproportionate amount of time focussing on human issues and viewing them as the main cause of accidents. Another influencing factor in industry choosing this trajectory for the analysis of accidents was the work of Heinrich, who declared that 88 percent of all accidents are the result of human error [5]. A key issue with focussing upon the symptoms of human error is the underlying causes which helped create the error are ignored [6] as well as the weaknesses in the organisational and regulatory system which created the environment for the error [7]. These less direct forms of human failure help to establish the working practices that result in operator error [8].

The report used for Condition 1 was a real accident report written after an accident occurred on a construction project. It was modified only by removing identifying details. The writing style used by the original report's author is human-error focussed, with minimal focus on the underlying causes of the errors [Appendix B].

2.3.2. Condition 2

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There are many safety researchers who encourage the operational world to move away entirely from a focus on human error and towards a complete system focus. Accidents today are much too complex to understand through traditional accident analysis which aspired to find individual broken components such as human error [9]. System behaviour cannot be deduced from component behaviour [10] as "simple entities, because of their interaction, cross adaption and cumulative change, can produce far more complex behaviours as a collective" [11].

There are many methods used in the world today to analyse accidents using a systems approach. Functional Resonance Analysis Method (FRAM) [12], Accimaps [13], Systems Theoretic Accident Model and Processes (STAMP) [9] and Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis are just some of the processes used to better understand complex accidents.

The report used for Condition 2 was based on the same accident used for Condition 1. This report was written by the first author for this experiment. Participants were provided with a one paragraph summary of the accident followed by a SWOT Analysis of the 5 elements deemed necessary to achieve success [Appendix C].

These elements were:

- Daily Activity Briefing,
- Personnel,
- Tools and Equipment,
- Work Environment,
- Task Execution.

2.3.3. Condition 3

Traditionally, accident reports consisted of a singular narrative describing the event. The role of the accident analysis facilitator was to objectively collate the facts related to the event and to provide a story for others to better understand what happened and how. The accident analysis lead would cherry pick what they believed to be the important aspects from each statement of those involved in the event and use this information to create a linear story. A key failure in this approach is that it is impossible for the facilitator to avoid hindsight bias using this method, given that they are aware of the outcome of the event. Hindsight allows observers to change past indeterminacy and complexity into order, structure, and oversimplified causality [14]. The facilitator often cherry picks elements from each actor's story to help create the story they believe to be true. This story is often littered with counterfactuals highlighting what the operators could or should have done. However, saying what people could have done to prevent a specific outcome does not explain why they did what they did [15].

The report used for Condition 3 again communicated the same accident as Condition 1 and 2. This report, written by the first author for this experiment, used the "multiple stories" approach [Appendix D]. Each actor's account was recounted verbatim in the final report to ensure everyone's voice is heard, whether conflicting or not, and this became the accident report. The issues and constraints faced by those involved and captured in their story were listed as contributing factors to the accident.

3. Results

Overall, there were 298 corrective actions proposed by the participants across the 3 conditions; 99, 100 and 99.

3.1. Coding

Proposed corrective actions were coded into 2 categories: 1) Human/ blame focussed, 2) system focussed. Each category was further broken down into sub-categories. Human/ blame focussed was divided into the following elements: 1) Punish the people involved, 2) non-punitive action focussed on the people involved (e.g. training, reinforcement of correct behaviour). System focussed was divided into the following groups: 1) One-off actions such as communicating about the accident or

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reviewing the risk register considering the accident, 2) changes to the physical workplace, 3) reinforcement or change to the work practices specifically involved in the accident, 4) reinforcement or change to practices not directly involved in the accident 5) changes to documents. A separate category was provided for any counterfactual statement found. This category was then separately coded using the 2 main categories.

Each participant's response was weighted equally – as a single point towards the analysis.

Participants' corrective action suggestions were coded blindly by two coders. Cronbach's Alpha – a measure of reliability – was 0.957759 indicating good agreement between the coders. The coding made by the first author were used for the remainder of the analysis.

3.1. Findings

Overall, participants were more likely to propose system-focused corrective actions (255 actions - 86.44%) than human error-focused (40 actions - 13.56%). However, as predicted, the actions participants proposed to manage the issues which led to the accident varied greatly depending on the framing of the story and the language used to describe the event. Participants provided with Condition 1, in which the story is told in a linear manner by the accident analysis lead using language equivalent to that used by law enforcement when investigating a crime, were more likely to suggest actions with a human error/ blame focus (27 actions - 27.55%) than those provided with the Condition 2 (8 actions - 8%) or Condition 3 (5 actions - 5.15%) reports, $\chi^2=25.39$, $p<.001$, see Figure 1.

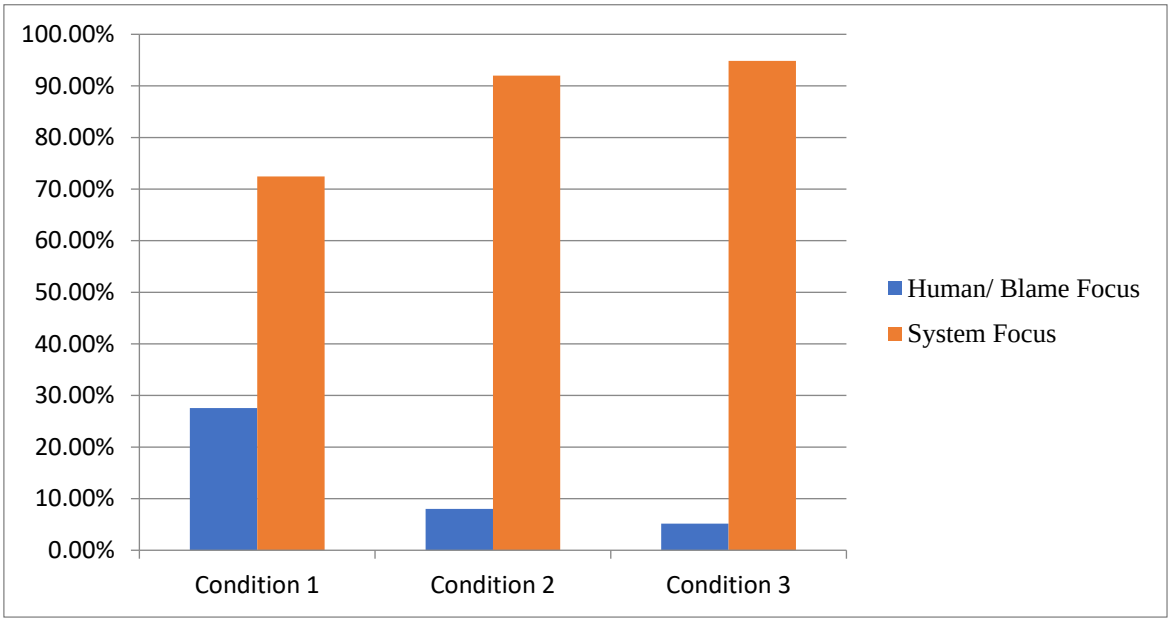

Figure 1. The figure above displays the number of human/ blame focused recommendations against the number of system focused recommendations provided for each condition.

Table 1. The table below displays the distribution of accident classifications across the 3 conditions.

Classification	Condition 1	Condition 2	Condition 3
Non-punitive action focussed on the people involved (e.g. training, reinforcement of correct behaviour)	8	2	1
Punish the people involved	4	0	0
Counterfactual statement – Human Focus	15	6	4

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Classification	Condition 1	Condition 2	Condition 3
Counterfactual statement – System Focus	1	12	12
Changes to documents	1	0	3
One-off actions such as communicating about the incident, or reviewing the risk register considering the accident	6	10	9
Changes to the physical workplace	7	16	6
Reinforcement or change to practices not directly involved in the accident (e.g. toolbox talks, site coordination, competency management)	32	28	50
Reinforcement or change to the work practices specifically involved in accident (in this protecting against dropped tools)	25	26	15

As seen in Table 1, readers of the Condition 1 Report were the only participants from all 3 Conditions who requested punishment for the individuals involved (4 actions - 4.04%).

Appendix A contains examples of the recommended actions in each classification.

4. Discussion

The purpose of our study was to determine whether the language and framing of an accident report would influence the reader's proposed corrective actions to manage the problems found. Our results clearly show a correlation between the framing, language and structure of an accident report and the type of action decided upon by the reader. This aligns with the findings of Thibodeau and Boroditsky [1] which showed that language and metaphors have a powerful influence over how people attempt to solve complex problems. In the same way Thibodeau and Boroditsky showed that enforcement was the more likely choice when crime was described as a "beast", our results show that punishment for the worker is more likely to be sought where the language and framing of the report is consistent with the description of a crime. The findings also give weight to the theory that by using a multiple stories approach [16], the reader is more likely to take restorative measures to action the problems found.

A limitation of the study is the fact that it was conducted in abstract. This creates the potential for participants to respond differently to how they would respond to an accident report within their workplace because of the removal of any socio-political aspects which may exist in their organization.

4.1. Implications for Practice

The findings in this study strongly suggest that, independent of the underlying facts, the language and structure of an accident report may have a significant impact on the outcomes of an accident analysis. This has important implications for any organisation seeking to achieve a "just" culture. The accident process is a core element in establishing and maintaining a learning culture within an organisation. The learnings from accidents, particularly high consequence, often influence an organisation's future safety strategy. Facilitators of accident analyses must accept that how they frame the story within their reports has serious implications for those involved and the future ability

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of the organisation to learn. Our results have shown that a human-focussed report greatly increases the potential for recommended actions to be blame-focussed. The use of blame is harmful to an organisation [16] as the workforce is much less likely to report accidents and other problems in a workplace where blame is used [17].

Author Contributions: For this research article, members of the research team made the following contributions;

- Conceptualisation – D.H., A.R. and S.D.
- Methodology - D.H., A.R. and S.D.
- Resources – D.H.
- Data Curation – D.H.
- Formal Analysis – D.H. and A.R.
- Writing – original draft preparation – D.H.
- Writing – review and editing – A.R.
- Supervision – A.R. and S.D.

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Conflicts of Interest: The first author is an employee in one of the organisations in which the research was carried out. To minimize any risk associated with this, the second author provided oversight and all data collected was classified independently by both authors before being tested using Cronbach Alpha.

Appendix A – Examples of recommendations made by the participants

Table A1. Examples of human-focused recommendations

Condition	Classification	Recommended Action
1	Punish the people involved	Disciplinary action against supervisors for improper briefing
1	Punish the people involved	Immediate dismissal of mechanical crew
1	Non-punitive action focussed on the people involved	Training/ Re-briefing to teams on working procedures
1	Non-punitive action focussed on the people involved	Brief/ retrain operatives to comply with approved RAMS. Brief/ retrain supervisor on is duties to ensure compliance with RAMS i.e. Correct equipment available, fit for purpose, ensure operatives understand and comply
2	Non-punitive action focussed on the people involved	Better training or the appropriate tools for the task
2	Non-punitive action focussed on the people involved	Provide adequate training to update existing skills
3	Non-punitive action focussed on the people involved	POWRA - retraining is required. A POWRA should only be done at the point of work. If done correctly the lack of correct tools, unsuitable mats, not used lanyards and incomplete scaffold - this should have prevented the job being started until all these aspects were solved

Table A2. Examples of system-focused recommendations

Condition	Classification	Recommended Action
1	Reinforcement or change to the work practices specifically involved in accident (in this protecting against dropped tools)	Given the scope of the overall works, all tools should be fitted with lanyards and their use made compulsory with recorded training given to all operatives
1	Change to induction training	Reinforcement or change to practices not directly involved in the incident (e.g. toolbox talks, site coordination, competency management)

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Condition	Classification	Recommended Action
1	Changes in documents	HOLD POINT in RAMS. Appointed Supervisory Staff (Person in Charge) should check and confirm Risk Assessments have been read, that all safeguards and risk prevention/mitigation measures are in place prior to the work commencing (mats, nets, barriered impact areas below, lanyards, tools), and are signed off before commencement, especially high risk and safety critical works.
2	Reinforcement or change to the work practices specifically involved in accident (in this protecting against dropped tools)	Competent scaffold inspection should be done weekly
2	Reinforcement or change to practices not directly involved in the accident (e.g. toolbox talks, site coordination, competency management)	Introduce pre-start briefs between different trade team leaders to achieve better communication
2	Changes to the physical workplace	Adequate protection of assets should be applied to equipment
3	Reinforcement or change to the work practices specifically involved in accident (in this protecting against dropped tools)	Apply exclusion zones below teams working on scaffoldings. Rotate teams working so that always an area is available to work. Tag scaffolds when complete and safe to use, install signage, improve communication
3	Reinforcement or change to practices not directly involved in the accident (e.g. toolbox talks, site coordination, competency management)	Managers to re-consider commercial embargos when relates to safety as low costs that are avoided might cause great losses following an accident
3	One-off actions such as communicating about the accident, or reviewing the risk register considering the accident	Use this adverse event to highlight to management the potential consequences that upstream commercial/ programme decisions can have on downstream operations - Introduces additional variables - "blindsided"

Table A3. Examples of counterfactual recommendations

Condition	Counterfactual Classification	Recommended Action
1	Human	Workers should have used the tool lanyards
1	System	Have the correct tools for the job. If the correct sized torque tool been available there would have been no need for the torque multiplier. This would have meant that there would only have been a single tool for Jim to work with, reducing the chance of dropping it.
2	Human	Badly layed out platform/ work area
2	System	Money was a problem which led to corners being cut
3	Human	Rushing, lack of communication, badly briefed, bad supervision, briefings should have been held in a better place
3	System	Change the culture associated with Safety Paperwork. Both Operatives stated that the POWRA would be used 'against them' if something went wrong. POWRA are there to prevent accidents, not apportion blame. Form should have also been amended to reflect the actual method of work

Appendix B – Accident Report 1

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Incident / Incident No:	11111		**Incident Date:**	22-09-2017	
DETAILS OF PERSONS INVESTIGATING INCIDENT					
Team Leader Name	John Smith	**Position**	Project Safety Manager	**Contact No.**	555-1234
Team Leader Name	Peter Parker	**Position**	Senior Safety Advisor	**Contact No.**	555-2345
BASIC INCIDENT DETAILS					
Incident Date (dd/mm/yy)	22-09-2017		**Incident Time (24 hr)**	09:00am	
Incident Site Address	London				
Location of Incident on Site	Brine Concentrator 1				
Person Responsible for Workplace	Mark Masterson				
Step 1: Incident Level Classification					
Actual Injury			The class of actual injury was - **Nil**		
Potential Injury			The maximum reasonable potential class of injury was – **High**		

STEP 2: Observation / Information Gathering

Instructions for Gathering Information

Our first priority is to understand the incident and how the damage was sustained.

1. **Interview persons involved –** Include witnesses / supervisors / experts.
2. **Inspect the incident scene –** Take measurements (do not guess), photos, videos, drawings, diagrams / sketches.

Collect related documentation – Attach additional material as appropriate such as POWRA, RAMS, Risk Assessments, induction records, toolbox talks, DABs, H&S committee minutes, subcontractor/client incident report, relevant design documentation, operator's manuals.

List of Persons Involved (Full name and contact phone number)

Name	**Contact Phone**	**Position**	**Employer**	**Witness**		**Statement Attached**	
				Yes	**No**	**Yes**	**No**
Jim Johnson	555-3456	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Ben Benson	555-4567	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Lionel Leslie	555-5678	Cladding Specialist	Superior Insulation	☒	☐	☒	☐
Mike Michaels	555-6789	Mechanical Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐

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Clive Conlan	555-8901	Scaffold Working Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐

STEP 3: Give a DETAILED DESCRIPTION of the incident

On Friday the 22nd of September 2017 at the 07:30am Daily Activity Briefing (DAB), Mike Michaels, the Mechanical Supervisor, tasked Jim Johnson and Ben Benson with carrying out works at the top of Brine Concentrator 1. It was also addressed by Mike Michaels at his pre-start that Superior Insulation would be working in the same area, though the workers associated with the incident later reported that they did not hear this advice.

Figure 1: Brine Concentrator 1

Jim and Ben set off after their DAB to get the tools required for their task, which was to torque the bolts to the flange on the man way covers on BC1. Once they had acquired the torque wrench that they required for their task, they proceeded back to the base of BC1. They then went their separate ways as Jim went to the Main Process Building in order to get a torque multiplier and Ben went down to the Lime Silos in order to get tool lanyards for their task. These lanyards were items that he owned. They were not issued by the stores. Jim stated that he would have preferred to use a ¾ inch drive torque wrench but there were only ½ inch drive torque wrenches available. ¾ inch drive torque wrenches were requested but were unavailable due to commercial reasons. This then necessitated the requirement to use a torque multiplier.

Figure 2 – Torque Multiplier

Once they had both collected their required tools, they again reconvened below BC1 where they met Steve Stevenson from UK Gas Ltd., who was there to carry out a visual inspection to confirm the cleanliness of the flood box inside BC 1. They received Clive Conlan's permission by radio for access to BC1 before making their way to the top of BC1; as read by the access procedure in force. Ben Benson saw Superior Insulation workers working on the scaffold as he was walking up to his

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work area and he never communicated to them that he would be working above them. Once Jim Johnson, Ben Benson and Steve Stevenson reached the top floor, they showed Steve the inside of the BC before closing up the door. Steve then left the area.

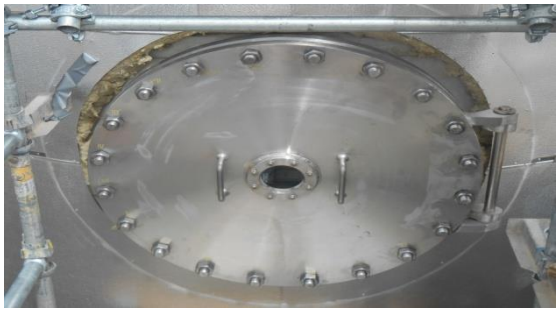

Figure 3: Brine Concentrator Door

Both Jim and Ben commenced work on the door. The nuts, bolts and washers were installed and hand tightened. The bolts on the door way were then numbered sequentially. Ben took the torque multiplier from its box, carried out some required calculations, set the tool up and then handed the tool to Jim. Jim then placed the multiplier over nut number 1. He asked Ben to hand him the torque wrench. It was at this moment that he knocked the multiplier off of the bolt and it bounced on the scaffold before falling 8 floors (16 metres) below. There had been no lanyard on the tool and no drop mats in place, despite the worker's Point of Work Risk Assessment (POWRA) highlighting both of these controls. The lanyards had remained in Ben Benson's bag, which was at the work front. There was also the fact that Ben Benson did not sign onto the task POWRA.

Figure 4: Work Area with Visible Gaps

Figure 5: Damage to Brine Concentrator – Post-Impact

No catch net had been taken from the stores up to the work front.

The tool that fell weighed 3.8 kg and hit with a force of approximately 607 kg, based on subsequent calculations.

After the event, Ben proceeded down the scaffold stairs before finding the tool 8 floors below. It was lying next to the Superior Insulation crew. At the time of the event, they had been standing approximately 3 metres away. Once Ben had seen that Superior Insulations' workers were not injured, he alerted Jim, who came down and apologized. Jim then called Mike and alerted him of the incident.

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Once Mike arrived, he secured the scene before calling the site Safety Manager. John Smith then began an investigation. Both workers returned negative results when drug and alcohol tested.
STEP 4: BASIC LEVEL INCIDENT ANALYSIS
1. List Elements List the "people", "equipment", and "environment" elements involved in the incident

PEOPLE	EQUIPMENT	ENVIRONMENT	
Jim Johnson	Norbar Torque Wrench Multiplier HT3 3/4	**Time**	09:00am
Ben Benson	Torque Wrench	**Lighting**	Good
Lionel Leslie	Tool Lanyards	**Climate**	Warm
Mike Michaels			
Justin James			
Clive Conlan			
Kevin Kelvin			

2. List Factors For each element listed above identify essential and contributing factors based on the focusing questions in the left-hand column. ***Essential*** **=** Factor is essential for damage to occur. ***Contributing*** **=** Factor increases the likelihood damage occurs but removal may not interrupt incident
ESSENTIAL AND CONTRIBUTING FACTORS
Both superior insulation and the mechanical crew were told at the daily activity brief that there would be other work crews in their area but they advised that this message had not been heard by them.
The mechanical crew did not communicate with the superior insulation crew before carrying out works above them.
the workers stated on their POWRA that drop mats and tool lanyards were required but these controls were not implemented.
The workers had the tool lanyards at the job front but did not use them.
The RAMS stated the requirement for drop mats when working at height.
The most suitable tool for the task, a ¾ torque wrench, was unavailable to the workers at the time of the incident.
4. List Recommendations From the *effectively controllable factors*, identified above, list corrective/preventative actions to manage this incident into the future.

CORRECTIVE / PREVENTATIVE ACTIONS REQUIRED	
1	
2	
3	

Appendix C – Accident Report 2

Exploration No:	11111	**Accident Date:**	22-09-2017
DETAILS OF PERSONS EXPLORING ACCIDENT			

Team Leader Name	John Smith	**Position**	Project Safety Manager	**Contact No.**	555-1234

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Team Leader Name	Peter Parker	**Position**	Senior Safety Advisor	**Contact No.**	555-2345
BASIC ACCIDENT DETAILS					
Accident Date (dd/mm/yy)	22-09-2017	**Accident Time (24 hr)**	09:00am		
Accident Site Address	London				
Location of Accident on Site	Brine Concentrator 1				
Person Responsible for Workplace	Mark Masterson				
Step 1: Accident Level Classification					
Actual Injury	The class of actual injury was - **Nil**				
Potential Injury	The maximum reasonable potential class of injury was – **High**				

STEP 2: Observation / Information Gathering

Instructions for Gathering Information

Our first priority is to understand the accident and how the damage was sustained.

1. **Conduct Discovery Sessions with the Team Involved –** Include witnesses / supervisors / experts.
2. **Analyse the Accident Scene –** Take measurements (do not guess), photos, videos, drawings, diagrams / sketches.

Collect related documentation which can compare work planned vs. work done – Attach additional material as appropriate such as POWRA, RAMS, Risk Assessments, induction records, toolbox talks, DABs, H&S Committee minutes, relevant design documentation, operator's manuals.

List of Persons Involved (Full name and contact phone number)

Name	**Contact Phone**	**Position**	**Employer**	**Witness**		**Discovery Sessions Attached**	
				Yes	**No**	**Yes**	**No**
Jim Johnson	555-3456	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Ben Benson	555-4567	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Lionel Leslie	555-5678	Cladding Specialist	Superior Insulation	☒	☐	☒	☐
Mike Michaels	555-6789	Mechanical Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐
Clive Conlan	555-8901	Scaffold Working Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐

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STEP 3: Give a DETAILED DESCRIPTION of the accident

On Friday the 22nd of September 2017, a work crew were sealing a door closed on a Brine Concentrator (BC) via a scaffold structure 30 metres high when the torque multiplier being used to torque the bolts dropped through a gap in the scaffold structure to an area 16 metres below. The object struck the BC vessel approximately 3 metres from an insulation team's work area.

Figure 1: Brine Concentrator 1

Figure 2 – Torque Multiplier

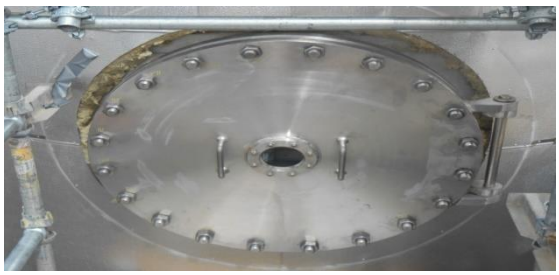

Figure 3: Brine Concentrator Door

Figure 4: Work Area with Visible Gaps

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Figure 5: Damage to Brine Concentrator – Post-Impact

SWOT Analysis

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CORRECTIVE / PREVENTATIVE ACTIONS REQUIRED	
1	
2	
3	

Appendix D – Accident Report 3

Exploration No:	11111		**Accident Date:**		22-09-2017
DETAILS OF PERSONS EXPLORING THE ACCIDENT					
Team Leader Name	John Smith	**Position**	Project Safety Manager	**Contact No.**	555-1234
Team Leader Name	Peter Parker	**Position**	Senior Safety Advisor	**Contact No.**	555-2345
BASIC ACCIDENT DETAILS					
Accident Date (dd/mm/yy)	22-09-2017		**Accident Time (24 hr)**		09:00am
Accident Site Address	London				
Location of Accident on Site	Brine Concentrator 1				
Person Responsible for Workplace	Mark Masterson				
Step 1: Accident Level Classification					
Actual Injury			The class of actual injury was - **Nil**		
Potential Injury			The maximum reasonable potential class of injury was – **High**		
STEP 2: Observation / Information Gathering					
Instructions for Gathering Information Our first priority is to understand the incident and how the damage was sustained.					

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1. **Conduct Discovery Sessions with the team involved –** Include witnesses / supervisors / experts.
2. **Analyse the accident scene –** Take measurements (do not guess), photos, videos, drawings, diagrams / sketches.

Collect related documentation which can compare work planned vs work done – Attach additional material as appropriate such as POWRA, RAMS, Risk Assessments, induction records, toolbox talks, DABs, H&S committee minutes, subcontractor/client incident report, relevant design documentation, operator's manuals.

List of Persons Involved (Full name and contact phone number)

Name	Contact Phone	Position	Employer	Witness		Statement Attached	
				Yes	No	Yes	No
Jim Johnson	555-3456	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Ben Benson	555-4567	Mechanical Fitter	Perfect Construction Ltd.	☒	☐	☒	☐
Lionel Leslie	555-5678	Cladding Specialist	Superior Insulation	☒	☐	☒	☐
Mike Michaels	555-6789	Mechanical Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐
Clive Conlan	555-8901	Scaffold Working Supervisor	Perfect Construction Ltd.	☐	☒	☒	☐

STEP 3: Give a DETAILED DESCRIPTION of the accident

On Friday the 23rd of September 2017, the door of a Brine Concentrator was being secured with nuts when an accident occurred where the tool being used, a torque multiplier weighing 3.8 kg, slipped from the nut it was being used to tighten and fell through a gap in the scaffold deck onto a level 16 metres below, where a team on insulators were carrying out works.

Below are the accounts of those involved:

Jim Johnson – Mechanical Fitter

At our morning briefing, Mike, our supervisor, tasked Ben and I with helping Steve from UK Gas Ltd. carry out an inspection of the inside of Brine Concentrator (BC) 1 prior to its top entrance being sealed. Steve, who was also attending our briefing, said that he would meet us at the BC 1 gate at around 08:30am. Apparently Mike also told us at the briefing about Superior Insulation also working on BC1 on a lower level than us but I definitely didn't hear that. In saying that, that doesn't mean he didn't say as it wouldn't be the first time we didn't hear some of Mike's announcements due to that stupid generator running right behind our briefing area.

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Figure 1: Brine Concentrator 1

Once the briefing was over, Ben and I headed over to the stores to get the gear we needed to carry out the job. We were only able to get the ½ inch drive torque wrench from Al the store man as all of the torque multipliers were in the field. Really and truly, what we really needed was a ¾ inch drive torque wrench for this kind of job as this would have meant not having to use a heavy and awkward torque multiplier at height. Unfortunately, when we asked about buying some, Mike told us that the financial problems faced by the project meant that there was a freeze on buying any new equipment which meant we just had to make do with what we had.

Without the torque multiplier, there was no way of doing the job but luckily enough I knew one of the guys who had one out from the stores.

Figure 2 – Torque Multiplier

Ben and I headed over to the BC1 gate to drop off the torque wrench at the base. While there, we also carried out our Point of Work Risk Assessment (POWRA) to get it out of the way. I then headed off to the Main Process Building (MPB) to borrow the torque multiplier for the job while Ben headed to the Lime Silo area as he had left his tool lanyards down there the day before when we were down there installing the internal hopper.

By the time we both got back to BC1, Steve from UK Gas was waiting on us at the gate. Before entering, we were required to gain permission from the area owner, who at the time was Justin James, the Scaffold Superintendant. Justin being the area owner, created 2 problems:

1. He never answered calls via phone or radio
2. He had no understanding of our works which meant he definitely didn't see it as a priority

As per usual, we got no response from Justin. Instead, we called Clive Conlan, his 2nd in command, who came over quickly and signed us into the area. He didn't seem to really care what our task was as he himself was fairly loaded with works on the other BCs, where the scaffold systems had yet to be finished and were behind schedule.

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Steve, Ben and I headed up the scaffold to the upper BC door. Steve, armed with a torch, stepped into the vessel and carried out his inspection. After giving us the thumbs up, Steve headed off back down the scaffold stairs. We were glad to get the inspection out of the way as it was a BC1 hold point and we were already a week behind program already and the milestone only round the corner in November.

With Steve now gone, Ben and I gave the POWRA a final look to ensure we didn't miss anything we could be pinged for afterwards. We did write down the use of rubber mats to prevent dropped objects but the problem we had was the site bought cheap mats which are useless in preventing a dropped object because they don't have the metal rings that the good ones have which allow you to connect them to a railing. Anything that hits the site mats just falls through as the mat isn't secured.

To be honest, on any other job I've been on that has a lot of working at heights on a scaffold, the scaffold is usually fully insulated with netting to prevent anything from dropping.

We then pushed the door of the BC shut and set up our work area, with the tools well away from the gaps in the scaffold. We first placed all of the nuts on the door bolts. This was a job that we had to be really careful with as one slip of the finger could have meant a nut dropping to the floors below.

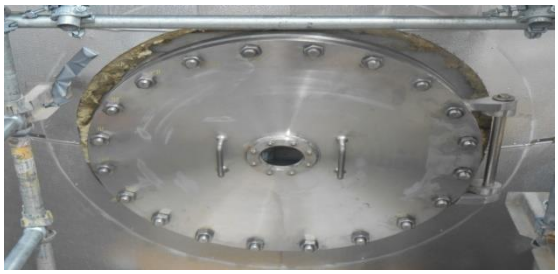

Figure 3: Brine Concentrator Door

Once all the nuts were on and numbered correctly, we moving to the torque phase. I was lead and Ben was support. Ben handed me the torque multiplier and I placed it carefully on the bolt number 1. I never even noticed that it didn't have a lanyard attached. Ben then handed me the torque wrench but as he did, my other arm made contact with torque multiplier and it slipped from the nut and fell below. I froze for a second while Ben ran down the scaffold to see where it landed. After a few seconds I came to my senses when I heard shouting from below.

Figure 4: Work Area with Visible Gaps

I ran down the scaffold stairs and found Ben 6-7 floors below talking to the Superior Insulation guys who looked in shock. The torque multiplier had landed only yards from where they were working but luckily no one was hurt. I apologies profusely for my mistake to the guys. I then called Mike and told him about the accident. Mike arrived a few minutes later and secured the scene

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before calling John, the Safety Manager. Once John came, Ben and I were sent for D and A tests and sat in a room waiting on you.

Figure 5: Damage to Brine Concentrator – Post-Impact

Ben Benson – Mechanical Fitter

We started off our day at our morning briefing with Mike, our supervisor. Jim and I were given the task of babysitting Steve from UK Gas while he inspected the inside of BC1. We were then to immediately secure the door and torque the bolts. The issue we immediately saw was the bolts on the door needed a ½ inch drive torque wrench but we only had ¾ inch drive torque wrenches. The reason for this was because site refused to buy them due to additional costs and the current buying freeze due the project loosing shit loads of money.

We met Steve from UK Gas after the briefing and we agreed to meet at the BC1 access gate at 08:30am.

We then headed off to the stores to get our torque wrench and a torque multiplier. When we got there, Al the store man told us that he was all out of torque multipliers but he had the ¾ inch torque wrench. Luckily, Jim knew that Mark in the MPB had one and, since Mark owed him a few favours by now, he would use this to cash one in. I didn't bother getting any tool lanyards from Al as the quality of his were poor and my own, which were in the Lime Silo area, were much more suitable for holding a 4kg tool in place.

When we had gotten what we needed from Al, we walked back to the BC1 gate and dropped off the torque wrench and wrote up our POWRA for the planned job. Jim then headed towards the MPB to collect his torque multiplier while I headed to the Lime Silos to collect my tool lanyards.

While down at the Silos I also saw the rubber mats I had used for the job we had done there the day before on the hopper. I didn't bother bringing them with me as they were useless in stopping anything from dropping as they had no way of securing them to anything.

Jim and I reconvened at the BC1 gate where Steve from UK Gas was now waiting for us. We tried calling Justin, the area owner, but as usual he didn't answer. Jim then called Clive, his blue hat, and he came over and allowed us in. The usual protocol is for the area owner to walk out the task with the guys before authorizing but poor Clive clearly didn't have time for this as his scaffold team was behind. The milestone targets that were agreed for these BCs were ridiculous which meant that everybody was chasing their tail trying to hit dates they never agreed to in the first place.

Jim and I, with our tools with us, headed up the scaffold with Steve. We walked past Superior Insulation but at the time I never even noticed that they were there.

Once we reached the BC door, Steve gave the inside of the BC a swift inspection before giving us the thumbs up and heading off. As always, we gave the POWRA a quick once over to ensure we

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hadn't missed anything that could be used against us later. In hindsight, I probably should have removed the rubber mats from it but it didn't cross my mind at the time.

We set up our work space so that there was minimal movement for us to do. We were well aware of the gaps in the scaffold so we had to keep all of our gear well away from these. Instead of leaving the bucket of nuts under Jim while he placed them, we kept them beside me behind him and I handed them to him. A bucket of nuts falling through a gap can cause a lot of damage!

When all the nuts were placed and numbered, Jim asked me to hand him the torque multiplier. I instinctively reached for it and handed to him. He carefully placed it on bolt number 1 before reaching back for the torque wrench I was about to hand him. It was then I heard a noise and Jim said "oh shit". I looked to where the multiplier was and all that was left was the bolt and nut and then we heard a bang. My first thought was, "I forgot to put the lanyard on the multiplier." The only reason I can think of that caused this was fatigue. Due to manpower shortages, I worked through my last R&R and Friday was my 19th day straight on site and these 12 hour days take their toll.

I instinctively ran down the stairs and about 7 rows down I found the tool lying beside the Superior Insulation guys, who up until that point, I didn't even know were there. They were both quite ashen faced and when I asked them if they were ok, all I got was a mumble. I looked around at the BC and saw a big dent where the tool had made contact.

Jim came down after me and when he saw the Superior Insulation guys he apologized profusely. He then rang Mike to come down.

When Mike arrived, he had a look at what happened and had a quick chat with the insulation guys to ensure they were ok. He then rang John, the Safety Mgr., to come down and have a look. When John arrived, Jim and I were sent for D and A.

Mike Michaels – Works Supervisor

As usual, we started off with our morning brief. I gave all the boys their tasks and I asked if there were any issues from the previous day. The only issue raised was the noise of the generator behind us and how it made it difficult to hear what I was saying. Unfortunately, this was the only area we could use for the briefing and the generator was required to run 24/7 to power the welfare facilities. I then ran through the areas where there was specific risk. One of them was the Superior Insulation boys working a few floors under Jim and Ben.

After the briefing was over, I headed over to the induction room to meet my 2 new starters. We're under manned at the moment and I'm finding it impossible to hit the targets set by Project Controls, (none of whom have ever built a treatment plant). The new starters were badly needed but it meant half my day was going to be taken up with getting them the basics so they could work onsite.

I got a phone call around 9am about the accident. I went over straight away to see how bad it was. When I arrived, I saw that it was pretty bad. Jim's torque multiplier had fallen through a scaffold gap and landed 8 floors below near the Superior Insulation guys.

When I saw what had happened and how it had happened, I was angry.

The original design of the scaffold structure included the requirement for the scaffold to be fully meshed and with drop nets to cover the gap between the scaffold and the BC. This never got done because the scaffold team is under resourced and they were told to move to BC2 as soon as the

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basic scaffold structure was erected to ensure we hit the milestone. The milestone is the 1st of November and if we don't hit it, the project loses out on £20 million.
The tool which dropped should never have had to be used either. You only have to use a multiplier when the torque wrench being used doesn't suit the bolt being torqued. The boys asked me for ½ inch drive torque wrenches months ago but when I put in the purchase order, it was rejected because our corporate commercial team had put a freeze on the ordering off new equipment due to the money being lost on the project.
After a chat with the insulation boys to see if they were ok, I rang John Smith, the Safety Mgr. and told him what had happened. He came down shortly afterwards and assessed the area. He then sent Jim and Ben away for D and A while I rang Mark, the Project Director and told him the bad news and that his BC works would be delayed.

Lionel Leslie – Cladding Specialist
I attended Mike's morning briefing and listened as he allocated his team their tasks. I didn't really hear much of what he was saying as the generator beside us is extremely noisy and smothers a lot of the conversation. Someone told me after the accident that he spoke about Jim and Ben working above us but I never heard this; probably because of the noise.
Pete and I grabbed our tools and headed off to BC1. Clive was just at the gate with his own guys and he signed us into the area.
On floor 3, we started carrying out repair work at the back of the BC, with the staircase on the opposite side. We slowly made our way around the vessel. At around 09:00am, we heard a loud bang and a tool bounced off the BC and landed on the scaffold floor beside us. I was in shock as I didn't know anyone was above us and I hadn't seen anyone walk by.
After a minute or so of silence, Ben Benson came running down and looked towards the tool. He then began apologizing for what had happened. A minute or so later, Jim Johnson appeared and again began apologizing profusely for what had happened. I couldn't say much at the time as I was still thinking about how close I had come to being smashed by a tool.
Mike arrived soon after and again asked us if we were ok.
Soon after the Safety Manager came and began asking questions.

Clive Conlan – Scaffold Working Supervisor
I got a call from Jim Johnson at about 08:30am about getting onto the BC1 scaffold. I was on BC2 at the time and as we are behind schedule and I'm a few men down, I had to rush them through the sign in and didn't have time to talk them through the other works in the area, which I would normally do. I am not even supposed to be the area owner but my supervisor was unreachable so I got stuck with doing it on the day.
At around 09:30, I heard they had an accident but nobody was hurt. The tool would never have fallen through the gap had we been given time to install the mesh and the nets like we were supposed to. Instead we were rushed over to BC2 to start the scaffold on it. These milestone targets will be the death of someone.

STEP 4: BASIC LEVEL INCIDENT ANALYSIS

1. List Elements

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List the "people", "equipment", and "environment" elements involved in the incident			
PEOPLE	**EQUIPMENT**	**ENVIRONMENT**	
Jim Johnson	Norbar Torque Wrench Multiplier HT3 3/4	**Time**	09:00am
Ben Benson	Torque Wrench	**Lighting**	Good
Lionel Leslie	Tool Lanyards	**Climate**	Warm
Mike Michaels			
Justin James			
Clive Conlan			
Kevin Kelvin			

2. List Factors
For each element listed above identify essential and contributing factors based on the focusing questions in the left-hand column.
Essential **=** Factor is essential for damage to occur.
Contributing **=** Factor increases the likelihood damage occurs but removal may not interrupt incident

ESSENTIAL AND CONTRIBUTING FACTORS
The location of the briefing area next to a generator led to critical information being missed by the work parties.
Programme pressures led to essential dropped object prevention systems being omitted from the final design of the BC scaffold structure.
A commercial embargo led to an essential tool from being procured and a tool not suitable for the task being used.
The £20 million milestone achievement reward created an environment of time and resource constraints due to the creation of an unrealistic target date.
Time pressures led to critical information not being communicated during the sign in stage within the BC area.
The rubber mats available on site were useless when used to insulate a work area to prevent dropped objects as they had no means of connection to a structure.
A failure in the fatigue management system led to a worker being exposed to an excessive work pattern.

4. List Recommendations
From the *effectively controllable factors*, identified above, list corrective/preventative actions to manage this incident into the future.

CORRECTIVE / PREVENTATIVE ACTIONS REQUIRED	
1	
2	
3	

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