Usually, there are many people whose actions and decisions contributed to the incident over time. Identify these individuals and their actions.

At the scene, reconstruct and walkthrough the incident sequences. Pay special attention to:

- What was the task they were trying to accomplish
- What was the purpose of the behaviour that triggered the event or contributed to the event
    - What people could (not) see from their locations
    - Their body and hand position and what they were trying to achieve with it
    - The equipment and people they interacted with
- What was their understanding at the time of what the correct action to take is (what information they had at the time)
    - Where did that information come from (other people – who and how, documents, training etc.)
- What did they NOT know at the time of taking the action and why
    - WHO should have provided that information and HOW (e.g. engineer via X, training via Y, supervisor via Z)
- What were the constraints they had to deal with
- WHO else was part of this process (e.g. supervisor, another engineer, supplier, another operator etc.)
- Review how this task was performed in the past. Was there anything different?

For each person and their behaviour:

• Step 1 – Identify a single, well-defined behaviour which is represented in the cause map.
• Step 2 – Identify Assumptions / decisions / mind-set which underpinned the behaviour (why it made sense to them)
• Step 3 - Identify the Error Traps that may have influenced the person to make the error.
• Step 4 – Identify Management system causes / organizational which were behind the error traps.

Example 1: "*The operator continued filling the storage tank (behaviour) because he believed the tank was half-full (belief - why it made sense to them) due to an incorrect level indication from the level instrument (Workplace-level error trap) due to reduced maintenance budget in last 3 years which reduced the frequency of preventative maintenance (Error trap precursors).*"

Example 2: *"The operator used a wrong tool for the job (behaviour) because she believed it was the right tool for the job (belief – why it made sense to them) because the procedure was incorrect (Workplace-level error trap) as there was no process in place for managing updates to the procedures (Error trap precursors)."*

Types of error traps	Workplace-level error traps	Error traps precursors	People to interview	Other activities to gather evidence	Industry standards, guides and additional tools
Procedures / work instructions	• Inaccurate / Out of date • Unworkable in practice • Made it more difficult to do the work • Time consuming / quicker way possible • If followed to the letter, could not get the job done in time • Does not describe the best way to carry out the job • Difficult to know which is the right procedure • Too complex and difficult to use • Safety related information (hazards & controls) and warnings are not presented in operating procedures • Difficult to find the information you need in the procedure • Difficult to locate the right procedure • Not aware that the procedure exist • Not aligned with the training provided • Use of suppliers' / clients' procedures	• There is no process in place to: 1. Monitor the use of procedures and provide feedback 2. Systematically evaluate error traps in procedures 3. Promptly redesigning or scrapping bad or superfluous rules • The software used doesn't allow for quick finding the needed procedure. • Workers don't receive training and feedback on how to use the procedures. The use of procedure is not part of competency verification. • Workers are not involved in writing procedures. • Leaders don't proactively seek non-conformance to address them ASAP.	Operators who use the procedure / work instruction. Supervisors – are they aware and monitor the use of procedures. Engineers and others who co-wrote the procedure. Person responsible for the procedure management system and software.	Do a site walkthrough/ talk through with the selected procedure and operators and ask to show you how the steps are executed. Ask users to show you how they access procedures. If there are references or links to other documents ask users to show you how they access it.	 Are step by step procedures needed.JP  Procedures Audit Tool.pdf  Guidance on the development of site o  How to improve procedures.pdf  Example of a good procedure.pdf

	• Many procedures for the same task / activity? Are there any conflicts between them?				
Training and competency	Training wasn't provided for this job and developed skill proficiency and fluency? The competency of performing this task wasn't verified in the field. For tasks rarely performed there wasn't an opportunity to practice (dry run, simulate) There wasn't regular feedback provided on how well the person was performing the task.	A competency management system is in place describing how training and competence assurance is managed across different roles and levels Competency management isn't aligned and synchronised with procedures. Training content isn't determined based on need analysis and understanding challenges workers face (work as done) Training and competence arrangements don't consider skill decay and refresher training for key safety critical tasks that are performed infrequently. Training and competence records aren't monitored and accurately maintained. Training and competence of third parties who undertake safety critical tasks isn't managed to at least the same standard through contractor	Operators performing the task Engineers supporting the task and their competency Competency management system manager or equivalent HR person responsible for recruitment and selection – talk about recruitment criteria If the training is provided 3rd party, talk to the person responsible for training selection and the company who delivers the training	Review competence systems, training and assessment records Test if the training content matches the needs of the job Explore how the training effectiveness is evaluated and what is the refresher frequency. Records of individual's physical fitness/ capability for the task Test how the desired skills were assessed during the recruitment / selection process If training is provided by 3d party, explore how the training is selected, based on what criteria, how is it aligned with the competency management system	 Competence Management System  Human Factors Competency Assuranc  Managing competence for safety

		management systems such as tender evaluation and audit. Training and competence considerations aren't integrated into management of change processes Training and competence management arrangements aren't updated appropriately in response to accident and near miss investigations. There isn't process of audit and review of the effectiveness and efficiency of the competence management system.			
Resources: Time, Tooling, Equipment, and workstation design	• The person felt there wasn't enough time available to complete the job • Person didn't have all the information they need at the time to complete all the steps • There weren't enough people to complete the job • Right tools / equipment (in good working order) weren't available and used	Procurement / purchasing processes did not involve the end-users in defining requirements Product / purchase requirements did not match what workers needed in their context People responsible for purchasing / hiring tools and equipment didn't understand what workers need and their operational challenges Human factors and human-centred design philosophy wasn't integrated into	People who use the tool / equipment People who wrote and introduced rules / procedures for the use of equipment or work areas (e.g. what is forbidden in the yard) People responsible for design, manufacturing and assembly People responsible for determining equipment selection criteria and purchasing	Critically evaluate how design influences behaviour and increases likelihood of mistakes Consider short-term and long-term perspective. You may not be able to change the pump today, but your feedback can help designers to create better pumps in the future.	Human factors in engineering and design NOPSEMA  Human factors in engineering and desig Ergonomics standards for hand tools design  Ergonomic standards of handtools.pptx Spotting the design error traps and finding solutions - book of

	• Ergonomics design of tools didn't apply industry standards (see ergonomics standards file)
	• It is not easy to access and operate equipment and its controls comfortably
	• The dimensions and layout of the workstation and the work area did not allow for comfortable completion of the task and good body posture
	• When interacting with the tool / equipment
	  ○ Things didn't work the way they expected
	  ○ Different things (valves, buttons, gauges) were too similar
	  ○ Things were hard to see
	  ○ Things didn't work well together
	  ○ Things were hard to handle
	  ○ Things took too long to respond
		product development (see HF engineering NOPSEMA file).
		
		Engineers can't demonstrate understanding and use of HF industry standards.
		
		There was no a feedback loop between the users of tools/equipment and what makes the use difficult and the designers and manufacturers to allow for continual improvement.
			People who develop engineering requirements / standards and processes
			
			Suppliers who provide tools / equipment in use
					examples
					 
					Spotting the design error traps and findin
					
					ISO 6385 2016(en) Ergonomics principles in the design of work systems http://bit.ly/2O7ss3w
					
					ISO 9241-210 2010 Ergonomics of human-system interaction - Part 210 Human-centred design for interactive systems http://bit.ly/2O0BDmt
					
					Standard Practice for Human Engineering Design for Marine Systems, Equipment and facilities ASTM F1166 - 2007 http://bit.ly/2O3P7h9

Supervision	Supervisors didn't proactively engage with workers to understand error traps, what makes the work difficult and non-conformances Over last 6 months there wasn't evidence that supervisor displayed a range of people skills, built trust, promoted speak up, promptly addressed issues raised by workforce, spent time on the shop floor to understand how the work is really done. The supervisor didn't provide adequate job instructions and feedback. The supervisors didn't consistently communicate that safety is most important	Supervisors' roles and responsibilities weren't clearly defined and understood. Competence standards weren't in place for supervisory roles including: • Technical skills relevant to the process and plant • Non-technical skills (e.g. leadership, managing poor performance, communicating effectively) • Management of organisational performance influencing factors within their control (competence assurance, workload, staffing levels, shift work, fatigue etc.) Clearly defined arrangements weren't in place for the supervision of contractors Arrangements weren't in place to manage supervisor workload and hours of work to an acceptable level. There wasn't evidence of active monitoring / evaluation of the performance of supervisors	Team members Supervisors Supervisor's line manager HR person responsible for recruitment, selection, promotion, Site manager	Review competence standards for supervisory roles Review documentation relating to defined roles and responsibilities of supervisors Review performance appraisal documents	 Supervisor Interview Protocol and Interview  Guide to the use of behavioural markers c  Safety Leadership in Practice A Guide for M

		Recruitment / Selection and promotion requirements didn't take into account a range of technical and people skills.			
Operating under changed conditions and Management of Change	There were similar parts, buttons, valves, levers, gauges etc. that could be easily mixed up and confused with others Parts of this task changed recently? This task was performed in an old way Parts of the task were different from usual routine? A new tool was confused with the previous version? Parts of this process were as expected, e.g. valve opens to the left whereas all other valves open to the right It was a new situation that required improvising or trouble shooting	• Changes of responsibility without adequate arrangements to ensure capability or competence • Reduction in supervision • Team-working deficiencies • Conflicting priorities • Loss of key skills or knowledge • Lack of clarity about important functions and responsibilities • Change of priority away from related tasks • Reduction in available resources for maintenance • Inadequate staffing for handling upsets, crises, or peak workloads	Individuals affected by organisational change (either those affected by past changes / or to be affected by proposed change) Individuals responsible for the management of organisational change	The management of change policy / procedure the management of change risk assessment records of previously managed organisational changes documentation which has been modified as a result of organisational change (both previous and current versions)	HP in MoC Checklist.pdf
Communication and safety critical information	Team members didn't know they supposed to communicate with each other	Communication techniques weren't included in the competency system, systematically trained and evaluated	Operators and other people they communicated with Supervisor Competency manager	Review handover procedure, and handover notes. If radios are used, review if there is a protocol in place and if it was used	HSE guide on Safety critical communicatio

	Team members weren't in the working area and couldn't see or hear each other. Team members did not have common understanding of how to communicate with hand signals. For safety critical information, e.g. valve numbers operators did not use 3-way communication and phonetic alphabet. There was no protocol for radio communication in use. For activities spanning across shifts, there was no written and verbal handover in place. Language was a barrier Workers didn't receive key information from others they depend on, e.g. engineers, planners, safety, customers etc.	There wasn't a handover procedure and process in place. Safety-critical information which needs to be communicated was clearly defined There were no arrangements in place to monitor, audit and review the transfer of safety-critical information			 Safety Critical Communications The
Screens, displays, controls and actuators	Controls work in unexpected ways Controls that were hard to figure out	The design process of screens etc. wasn't based on ISO or other HF principles for human interaction with displays and control actuators, to minimize operator errors and to	Engineers responsible for design, assembly, refurbishment of the equipment Suppliers responsible for design to determine how	Engineering documents, blue prints, policies demonstrating requirements underpinning design. Ask a new operator to walk you through how they would	ISO 9355 — Part 1: Human interactions with displays and control actuators — Part 2: Displays

	Controls that were too far away from devices Controls that were too easy to activate accidentally Controls with ambiguous or unintuitive labels Controls that were too similar to each other Indicators do not show the control has been activated Unexpected placement of controls Users didn't receive feedback for actions they made on the interface Users were not able to easily reverse their actions	ensure an efficient interaction between the operator and the equipment. Engineers responsible for the design didn't have competency in HF in design. The contractors, suppliers and their sub-contractors didn't have HF design requirements integrated into their design processes.	they integrated HF design industry standards into their processes and competency Other operators using the displays and controls.	use the controls and what they find confusing. People who are performing the task on regular basis are more easily articulate the usability challenges	— Part 3: Control actuators — Part 4: Location and arrangement of displays and control actuators
Team work	Team member didn't anticipate the needs of team members. Team member didn't provide timely support to team members without needing to be asked. Team member didn't recognize when team members were having difficulty.	There were no efforts to build an effective team focusing on trust, communication techniques and mutual care.			IOGP Guide Introducing behavioural markers of non-technical skills in oil and gas operations Guide to the use of behavioural markers (

	Team member didn't check common understanding of the objectives of a task. Team members didn't act to avoid or resolve potential situations of conflict. Team member focused on what is right, rather than who is right.				
Fatigue	Person had more than 10h rest in 24h before incident Stress or worry that could interfere with sleep? High workload or physically arduous work completed The individual working nights for > 4 consecutive nights Overtime or double shift taken It was the first night on night shift The incident took place between 02:00 and 06:00 or 15:00 and 17:00 Tasks involving long period of concentration or mental demand	Fatigue risk management arrangements weren't informed through risk assessment The management of fatigue wasn't integrated into the safety management system Clear rules weren't established for maximum working hours, minimum rest periods, split shifts and changes to expected shift (e.g. last-minute change from day to night shift) Consideration wasn't given to the effects of mobilisation and demobilisation on both process and personal safety There weren't processes for employees to self-report fatigue and for dealing with individuals who may be suffering from the effects of	Supervisor – to determine typical working patterns Planner – to determine the demands on working time Site manager – to determine the availability of manpower resources Medic or health advisor – to determine approaches to managing fatigue	Review any fatigue risk assessments. Do they consider important fatigue risk factors such as shift design, hours of work, overtime and callouts, sleep environment (especially for nightshift workers), delays to mobilisation and demobilisation, effects of medication. Review the fatigue risk management arrangements. Is fatigue formally managed, are clear rules established for maximum working hours, minimum rest periods, split shifts and changes to expected shift (e.g. last-minute change from day to night shift). Review any monitoring data such as overtime and call out records. Can any issues be identified such as excessive	BPs guide to identifying fatigue contributing to incidents  Fact sheet Identifying and investigatingfatig Investigating fatigue in incidents tool  EI IFIT_fatigue_Tool_ext.p

	Others observed fatigue-related behaviors People didn't have a good understanding of fatigue symptoms	fatigue e.g. assessment and remedial action Key Performance Indicators and/or audits weren't used to monitor and review the effectiveness of the fatigue management arrangements Fatigue risk management awareness training wasn't provided for those with responsibilities for managing fatigue, including the workforce		overtime or repeated last-minute swing shifts? Inspect the sleeping arrangements for nightshift workers. Discuss how fatigue is managed with important personnel (CRO, Production Operators, Medic, Supervisors and OIM). Do they have a good understanding of fatigue risk? Are fatigue management arrangements implemented effectively? Do they receive any formal training on how to manage fatigue?	
Ambient Environment	The amount of light available made it more difficult to perform this task The noise level made it more difficult to perform this task The air temperature made it more difficult to perform this task	Resources for heating / Air conditioning, lighting, equipment generating noise	Facilities manager AND Site manager responsible for the budget and planning of facility conditions		 NORSOK S-002 Working environment