Perplexing Persistence of Poor Procedures

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Problems with procedures have been highlighted for many years. In its document Revitalising Procedures, the UK Health and Safety Executive [HSE 2004] cited links with major accidents, including Bhopal, Piper Alpha and Clapham Junction rail crash. “The consequences of inadequate procedures, or operators not following procedures, can be disastrous.” The document proposes multiple ways that procedures can be improved.

A review of letters sent by the Energy Division of UK HSE to offshore oil and gas installations in 2019 [Salus 2023] suggests that similar problems persist. It found numerous references to procedures and instructions that were “insufficient” (did not cover all reasonably foreseeable circumstances) and an inaccurate reflection of how tasks are carried out in reality. Underlying issues included a lack of evidence that procedures were being monitored, audited or updated following reviews and changes.

Gregory Smith, in his book “Paper Safe” [Smith 2018], suggests that procedures have become part of a bureaucracy where requirements for paperwork are disconnected from the primary purpose of managing risks. Procedures are written and their use is mandated to satisfy a key performance indicator or provide evidence that an activity has taken place. This creates an illusion that safety is managed well whilst making work more difficult. Smith suggests that workers are content to play along with the bureaucratic process and management are prepared to accept it, because it has been normalised.

It is not clear whether any industries have solved the problems with procedures, but it seems that the process industry is still suffering from the problems identified decades ago. This is despite plenty of guidance being available that is supposed to help people to write better procedures. The recently published operational delivery guide for human factors related to the Control of Major Accident Hazard (COMAH) regulations, states that “The key issue when preparing procedures is to consider who the documents are intended for and what they are expecting them to be used for i.e., the procedures need to be proportional for their intended purpose.” It goes on to say that a framework is required to optimise usability of procedures that supports day-to-day compliance.

One of the issues seems to be a lack of ownership. Engineers are often expected to have a key role in writing, reviewing and approving procedures but it is an additional burden on an already busy workload that they want to close out as easily as possible. In an effort to follow the good practice of actively involving end users, the task of writing a procedure is often delegated to an individual from the operating or maintenance team, without any training or clear guidance about what is expected. Alternatively technical authors are employed who turn out nicely presented procedures that seem no better in practice than those written by non-experts.

One conclusion that is hard to avoid is that current guidance has not been effective. Either it is fundamentally wrong or it is not setting out practical solutions that actually produce useful procedures. This paper will identify where guidance is failing and propose solutions based on practical experience. Issues to be discussed will include:

- Procedure end user – someone deemed competent to perform the task;
- Procedure purpose – increase consistency of task methods and reduce likelihood of errors that may have significant consequence;
- Preamble (e.g. purpose, aims, glossary etc.) – support pre-task briefing or tool-box-talk;
- Warnings and cautions - use sparingly, in very clearly defined circumstances;
- Diagrams and photos - use sparingly where there is a clear benefit;
- Signatures – tick-boxes are sufficient for steps with sign-off at key stages;
- Style – minimum wordcount using consistent terminology;
- Supporting information – keep it separate in a ‘notes’ column;
- Improved understanding – multi-layer hierarchical structure explains why steps are performed;
- Step numbering - hierarchical structure makes updating easy.

One of the key learnings from practical experience is that technical perfection is unachievable and ultimately unnecessary because the circumstances of work vary. This is challenging for people (typically engineers) expected to approve procedures who may fear personal liability if an error contributes to an accident. However, having a process to handle contingencies is far more important than enduring the diminishing returns of endless content reviews. A good but imperfect procedure will provide better support to competent people performing a critical task than an unissued procedure waiting for approval.

Key words: Human Factors, Human Factors Integration Plan, HFIP, Simultaneous Operations, SIMOPS, major project, temporary project, project lifecycle, construction and commissioning, rental equipment, contractors

Introduction

Perhaps I work for a lot of rogue companies but most operating procedures I see are pretty poor; and 'proper' maintenance procedures are almost non-existent. Even procedures I have helped write in the past, although usually well received by process operators and maintenance technicians, have flaws when I look at them with a critical eye.

Templates, general formatting and version control (on paper at least) are often OK, which I guess is good news. Quality of technical content varies, with some being way off the mark whilst others, when you take the time to understand what they say, can be quite close to how the task is performed in practice. But the issues I see, backed up by the comments of the people expected to use them, are that they are too long, wordy, ambiguous and difficult to use in practice.

The good news is that process operators, and to a lesser extent maintenance technicians, are looking for procedures to support them doing their job. When I started my career in the 1990's that was not the case. Procedures were viewed as a management device and most front line workers didn't feel they needed them. Some even saw it as an insult that managers thought they needed a procedure to tell them how to do their job. The strange thing is that everything has flipped, with front line workers wanting procedures and managers appearing to have lost interest.

One issue that particularly concerns me is the attitude of some technical experts (i.e. discipline engineers). They will reluctantly accept that procedures that fall within their area of responsibility need to improve but resist any attempt to change them. They insist that they must approve any updates but sit on them for weeks or months, claiming to be too busy to conduct their review. If the procedure is for a safety critical task this delay increases the time at risk when front line workers perform tasks without a suitable procedure to support them. If the technical experts are too busy working on other safety critical aspects it is reasonable that reviewing a procedure has to fit in with their other workload. However, I suspect that this is not always the case, and they are prioritising production over safety.

Scope for this paper

A procedure is an established way of doing something. It does not have to be written down but in industry when we talk about procedures we are usually referring to written documents that describe a method of performing a task or activity. That is the focus for this paper. Other terms are often used interchangeably including instruction, method statement and guide.

Some written procedures describe high level activities performed across a wide range of settings, typically as part of a management system. These may be described as management system procedures. This paper is mostly concerned with operating and maintenance procedures that describe methods of performing specific operations and maintenance tasks.

Evidence of problems with procedures

Problems with procedures have been highlighted for many years. In 2004 the UK Health and Safety Executive (HSE) published a document titled "Revitalising Procedures" [HSE 2004]. Based on decades of experience it identified poor procedures as a contributor to major accidents including Bhopal (1984), Piper Alpha (1988) and Clapham Junction rail crash (1988). It stated that "The consequences of inadequate procedures, or operators not following procedures, can be disastrous." The document proposes multiple ways that procedures can be improved, including:

- "Design the job or task so that the correct procedure is hard to avoid (e.g. by engineering-out short cuts through equipment design or programmable logic controllers);
- Base the procedure on how the task is actually performed. The operators may have devised an informal procedure that is quicker/easier and these methods should be incorporated into the formal procedure (as long as safety/quality issues are not compromised);
- Identify incentives to take short cuts (such as work pressures) and address these directly;
- Adopt a control and review process to keep procedures relevant and up-to-date."

More recently a review of letters sent by the Energy Division of UK HSE to offshore oil and gas installations in 2019 uncovered evidence that similar problems persist [Salus 2023]. It found numerous references to procedures and instructions that were "insufficient" (did not cover all reasonably foreseeable circumstances) and an inaccurate reflection of how tasks are carried out in. Underlying issues included a lack of evidence that procedures were being monitored, audited or updated following reviews and changes. Recurring findings included:

- "Operating procedures for safety critical tasks either had not highlighted or contained all the safety critical steps necessary to maintain the health and safety of all personnel;
- Procedures were inaccurate in reflecting how tasks were being carried out in reality;
- There were no arrangements in place for the monitoring or auditing of operating procedures for safety critical tasks;
- Other procedures were either not being updated following reviews and changes or it could not be demonstrated that updates were being carried out."

Why do these problems persist?

The problems appear to be perverse because standards and guidance have been available for many years that have aimed to drive improvements in procedures. The introduction of quality standards in the late 1970s encouraged documentation of how

critical tasks and activities were carried out. Organisations including the HSE have published guidance on developing procedures to support safety.

Gregory Smith's observations in his book "Paper Safe" [Smith 2018] may give us some indication of why problems persist. He suggests that procedures have become part of a bureaucracy where requirements for paperwork are disconnected from the primary purpose of managing risks. Procedures are written and their use is mandated to satisfy a Key Performance Indicator (KPI) or provide evidence that an activity has taken place. But a written procedure is of little value if it is not used in practice, or the method it describes is not followed. The existence of a procedure is taken as a positive indication that creates an illusion that safety is managed well. However, unless the procedures are closely aligned to the end users' requirements they will often make work more difficult. Smith suggests that workers are content to play along with the bureaucratic process and management are prepared to accept it because it has been normalised. Improvement would require change, which is often met with resistance.

Underlying issues

It is perplexing that that the process industry is still suffering from the problems identified decades ago, despite plenty of guidance being available that is supposed to help people to write better procedures. The recently published operational delivery guide for human factors related to the Control of Major Accident Hazard (COMAH) regulations [COMAH CA 2023] may give a pointer to where things go wrong. Guidance is often focussed on the writing process, format, presentation and document control. However, it is the way procedures are used that is the most important issue. The operational delivery guide states that "The key issue when preparing procedures is to consider who the documents are intended for and what they are expecting them to be used for (i.e., the procedures need to be proportional for their intended purpose)."

> People interpret this message as meaning that the end users should be given the task of writing procedures. Whilst their active involvement is essential, procedures written by process operators and maintenance technicians are often poor. This is not the fault of those individuals because usually they have not been trained or given appropriate support. Often a lack of confidence in determining what needs to be included in the procedure leads to them writing every detail, feeling that this avoids them being criticised for leaving something out.

An issue raised by the operational delivery guide [COMAH CA 2023] is a focus on compliance. Whilst this sounds like a sensible aim it may set unreasonable expectations. For very simple tasks it may be possible to write a procedure that can be followed as written every time the task is performed. But these tasks make relatively little contribution to safety risk, especially at a major hazard facility. Writing fully accurate and detailed procedures for complex and hazardous tasks is difficult and can be counterproductive. Focussing on compliance can lead to people following procedures that they know are wrong, which can be particularly dangerous.

Who owns the procedures?

One of the perplexing issues is that people know there are problems with procedures but struggle to find the solution. One cause seems to be a lack of ownership. Engineers are often expected to have a key role in writing, reviewing and approving procedures but it is an additional burden on an already busy workload. They may aim for procedures that are technically correct and not see practicality as their concern. It can take considerable time to resolve issues, which can lead to very long delays in issuing new and updated versions.

Making the end users the procedure owners has some logic but rarely works in practice. Individual process operators and maintenance technicians may identify practical problems that mean a procedure cannot be followed as written, but there may not be a mechanism to resolve the issues as a team.

Handing over responsibility to technical authors, who may identify as professional procedure writers, can result in very nicely presented procedures. But technical authors rarely have either the technical knowledge or practical experience needed to create good procedures. Giving them ownership can improve KPI scores but the content can be poor.

The need for more or different guidance

Given that operating and maintenance procedures can make a positive contribution to risk management it is unfortunate that many are poor. The fact that this has persisted despite guidance that was intended to drive improvement is a significant concern. It could be the case that the guidance is correct and failure to apply it is the problem. But with similar issues being so widespread this seems unlikely.

Creating better procedures

The following suggestions may complement existing guidance for writing procedures. However, some fundamental issues may need to be resolved, requiring departure from current guidance.

Write for competent people

Although the importance of knowing who will use a procedure is included in current guidance, identifying them has been left open. Different groups of people may refer to procedures at times and they are likely to have different requirements. The primary users should be competent process operators and maintenance technicians because the way they perform the associated task directly influences the task.

People should not be performing tasks without first reaching a defined level of competence. Including details that may be useful to people who have not achieved this leads to longer procedures, which can obscure the most important information.

People are often told they should write procedures so that ‘a person from the street’ could follow them but if people with insufficient competence are being given a procedure and told to perform critical tasks there are far more fundamental issues that need to be resolved.

People learning a task may be considered an important secondary user of procedures, which may justify including additional information for their benefit. But they should be directly supervised until deemed competent and so including more details should not be necessary. They may benefit from more background information and technical details about the task, but that can be handled in different documents.

Support people performing a task

A procedure can describe a task perfectly but if it does not help the process operator or maintenance technician in some way it will fail to perform its primary purpose. The two main benefits of having a procedure are to increase consistency in the way tasks are performed and reducing the likelihood of errors that may have significant consequences. Maintaining a focus on these should ensure the correct information is provided and presented in the most effective way. Part of this involves identifying where standardisation is important, and where flexibility to match conditions and personal preference can be accommodated. Also, differentiating the critical parts of the task from those where error is less of a concern.

Specify how and when to use the procedure

Many organisations are vague about how they expect procedures to be used. It is implied that every procedure should be actively used whenever a task is performed, but this is not stated or ensured. After an incident questions are asked about why the procedure was not being followed. The reality is that competent people can carry out many tasks successfully without reading a procedure. Also, there are some tasks where following a procedure is simply not practical.

There should be a clear statement that describes how each procedure should be used in practice. For critical and complex tasks that are performed infrequently it is perfectly reasonable to expect the procedure to be printed, followed and signed each time the task is performed, even if the person is competent. For other tasks it may be appropriate to have a reference procedure to define the agreed task method but competent people can choose whether they actively use it, provided they perform the task using the agreed method. Expectations should be clearly defined. Review and audit should confirm that expectations are met in practice.

Name and number

Being able to find the correct procedure will reduce one of the barriers to use. Giving it a meaningful title using terminology the end users will understand will make sure they identify it easily. If there are similar procedures for different scenarios, indicating this in the title is better than in the main body because that requires the user to access the full procedure to decide which one they need to use.

A task numbering convention can be very useful. Using a unique number for each task and a code for different document types allows easy cross referencing and access to information. For example:

- OP and MP to indicate an operating or maintenance procedure;
- JA for job aids that may provide additional support (e.g. checklist, flowchart, diagram);
- RA for a risk assessment;
- SCTA for a safety critical task analysis.

The document number for an operating procedure for task 123, performed in area 01 of the NTH site may be NTH-01-123-OP, whilst the associated SCTA is NTH-01-123-SCTA.

Limit the preamble – support a pre-task briefing

It is not uncommon to see procedures that have more pages making up a preamble than the task method itself. This is consistent with a lot of the guidance that suggests every procedure should have multiple sub-sections to set the scene (e.g. introduction, summary, scope, purpose etc.). But information recorded here is often of little value and people skim over it when they are about to perform a task. This bloating creates negatives perceptions because procedures are longer than they need to be and important information can be missed if it is hidden amongst the trivia.

There is a role for the preamble for critical tasks because we do not want people diving straight in without thinking about what they are going to do. It is good practice to hold a pre-task briefing or toolbox talk and this can be reinforced by writing a preamble with this in mind. Useful information may include:

- Main task stages;
- Major accident hazards associated with the task and associated risk controls;
- Parts of the task vulnerable to human error or where human actions are relied on to control the risk;
- Unique aspects that require different approach from other similar tasks.

However, the aim should be minimisation. Setting standard preamble sub-sections in a procedure template often results in people writing trivial information just so they have something to write.

Define what to do if the procedure cannot be followed

Whilst the task method described in a procedure should match the way it is performed in practice this is not always possible. For some tasks it is impossible to predict the conditions that may be encountered when performing a task, and there is always the potential for unexpected issues to crop up.

It should be clear that procedures should only be followed if safe to do so. But if a task has been started and an issue arises there should be an agreed and documented course of action to take. This may be covered by a general guide that applies to every task, or included in each procedure. The action to take if the task cannot be completed as described may be along the lines:

- Stop task & convene a meeting to document an alternative method;
- If stopping the task would create a hazard:
  - Discuss with the team and continue to a safe hold;
  - Record the actions that were taken.

Only use warnings and cautions in very specific circumstances

Standard guidance is that warnings and cautions should appear before the task step they apply to. The logic is clear because it is no good if the process operator or maintenance technician reads it after they have completed the step. However, there is little guidance about when a warning or caution should be included.

Implementation is often very poor. Some procedures have more warnings and cautions than task steps. The information provided often duplicates (and sometimes contradicts) the following task step. In practice warnings and cautions are not as important or useful as they seem.

Including warnings and cautions can imply that some steps in a procedure are more important than others. But if steps are unimportant, why are they including in the procedure? For a critical task every step should be followed as written, whenever it is safe to do so. In this context it is difficult to see the benefit of adding warnings and cautions for certain steps and not for others, and it can imply that steps without warnings are optional. Covering hazards and controls in a pre-job briefing, supported by the procedure preamble, is a much better way of making sure people understand the risks they will be dealing with in the task.

The only time a warning or caution may be advisable is where a task step is fully reliant on human vigilance to avoid a potentially significant consequence. These should be very infrequent because process systems should have multiple layers of protection. If a warning or caution is deemed appropriate because there is no other layer of protection an action should be raised as a result of writing the procedure to investigate if more effective controls can be implemented.

Only use diagrams and photos where they add value

Whilst the adage “a picture is worth a thousand words” could appear to be relevant to procedures, experience suggests that the actual benefit to competent people rarely justifies the time and effort required to include them. They can make a procedure look attractive but are usually only of general interest and do not actually support the people performing the task.

Including diagrams can create management of change issues and if reference to a Process and Instrument Diagram (P&ID) or similar is considered essential it is often better to refer the process operator or maintenance technician to source document. If a customised version is beneficial it may be better handled as a separate document (e.g. job aid) that can be reviewed and updated separately.

Use ticks for place keeping not accountability

Many procedures include columns for date, time and signature alongside every step. The aim seems to be to hold people accountable for the task if there is a problem. This is often perceived as a lack of trust and the time and effort required to complete the columns is counterproductive.

Assuming agreement that procedures are intended to support competent people when performing a task the ability to keep track of progress is likely to be beneficial. A tick against each step is sufficient for this. Providing sign-off boxes at critical hold points is also useful, and including date and time for these makes sense. In fact the delay created by adding the date, time and signature can be a useful prompt to pause and take stock. The hold point should include statements regarding what is being signed for rather than generic text to say a hold point has been reached.

Be ruthless with wording

Guidance consistently says that wording of procedures should be clear and concise, which is totally correct. However, these are very subjective properties and experience shows that people struggle to achieve it. Also, it can lead to bad habits that increase the potential for error and misunderstanding. Wording is not trivial and should be subject to greater scrutiny than is often the case.

Being able to positively and accurately identify items of plant and equipment is critical. Engineers have a habit of relying on tag numbers because they write procedures from drawings (e.g. P&ID). This introduces potential for error, especially if items on the plant are not tagged. Human factors tells us that redundancy of information reduces the likelihood of confusion. For

procedures, using a description and tag number for each item of equipment should be mandated so that people have at least two different ways of identifying the correct item.

Another way of reducing the likelihood of confusion is to use consistent terminology throughout. It is common for the same valve to be described as ‘pump suction’ and ‘pump inlet’ in different steps of the same procedure. In one case, four different names were used to refer to the same fluid (two different brand names, ‘detergent’ and ‘wash fluid’). A simple way to address both issues is to list all items used when performing the task (e.g. valves, instruments, equipment) with the specific description and tag wording that will be used throughout.

Every line in the procedure should be reviewed to confirm the number of words has been minimised (whilst ensuring the meaning remains clear). Standard guidance to always use active voice contributes greatly but simple changes such as removing the word ‘the’ and using & instead of ‘and’ can also help. Guidance often cautions about using abbreviations and acronyms, but if these are familiar to the competent people using the procedure there should be no issue.

Redundant and consistent equipment descriptors can give further opportunities to remove words. For example procedure step “Ensure that the acid pump suction valve V101 is closed” can be worded as “Ensure acid pump suction V101 is closed.” It may not seem like much but over the whole procedure it can make a difference. Also, making this an aim creates a focus on the wording that is likely to create wide ranging improvements.

Add a column for notes

Having an extra column alongside the procedure steps allows supporting information to be included. It may be argued that this should not be necessary if the steps are described properly but it can be a useful way of minimising the word count for the step and in practice it gives people somewhere to write information, which may not be essential, but they are reluctant to leave out. Also, it can give space for the person performing the task to write notes.

Examples of information that can be recorded as supporting information include actions that may be taking place in parallel (e.g. by other people or an automated system) whilst a procedure step is being performed, things to consider when deciding when to finish performing a step (e.g. continue increasing set-point until temperature TI-001 reaches 176°C) or references to other sources of information (e.g. P&ID or control system graphic).

Red flag for major hazards

If major hazards are to be discussed at the pre-task briefing it can be useful to highlight where those hazards are likely to be encountered during the task. A numbered list of hazards in the preamble and use of a symbol (e.g. red flag ) with the associated number alongside the relevant task steps is one way of doing this. This allows people taking part in the pre-task briefing to flick through the procedure and identify the steps with flags. It may also trigger people to be extra vigilant when performing the task steps, although the benefit of this is less clear. The red flags with the number of the hazard can be included in the extra column provided for supporting information. The flags can also be added to hold point status statements.

Structure helps understanding

When people understand what they are doing and why, they are more likely to get things right. Also, they will be more able to recognise and respond to situations that may arise whilst performing a task. Competent people should have a reasonable understanding of the process and aims of a task, but for any critical and complex task that they perform infrequently (i.e. the tasks where a procedure is of most value) it may not be immediately apparent why a task should be performed in the defined way or what each part of the task achieves.

Whilst it may be acceptable to present a very simple task as a list of steps, a longer procedure should be presented in a structured way that helps people to understand what they are doing. For moderately complex tasks two levels of hierarchy should be sufficient, achieved by diving the overall task into sub-tasks. For complex tasks a third level (sub-sub-task) may be required. Detailed steps are then listed under each sub and sub-sub task

As a rule of thumb, each section should be limited to 10 divisions so that the task is broken into up to 10 sub-tasks, each being further divided into up to 10 sub-sub-tasks and each having up to 10 task steps. Some judgement is required, but if exceeded significantly (e.g. 20 task steps), an additional division should be considered. It is noted that this approach allows up to 1,000 task steps (i.e. 10 x 10 x 10). If this is not sufficient it may be because the task is too large to be handled by one procedure. The alternative solution of adding another level of hierarchy may be appropriate, especially if it is restricted to a part of the procedure, but this can get messy.

Give every step a unique number

There will be occasions where reference will be made to specific steps in a procedure. Making sure every step in a procedure has a unique number will reduce the potential for error. This is quite easy if the procedure has been arranged hierarchically as described above. An added advantage is that if a section of the procedure must be updated it is not necessary to renumber every other step that follows.

Hierarchical numbering is not a perfect solution because the strings of digits can get quite long. Alignment of numbers in the procedure can help people navigate through the sub-tasks and steps. Also, greying out the tick boxes for higher level in the hierarchy can help people to differentiate steps from headings. The following layout is suggested.

1. Prepare compressor for start

#	Description	Notes	✓
1.1	**Depressurise compressor**		
1.1.1	Open vent block V-103		
1.1.2	Slowly open vent needle V-104	Contents of compressor will start to flow to vent	
1.1.3	When suction pressure PI-121 at 0 barg, close vent needle V-104		
1.1.4	Close vent block V-103		
1.2	**Purge compressor**		
1.2.1	Connect hose to purge point V-201		
1.2.2	Etc.		

2. Start compressor

#	Description	Notes	✓
2.1	XXX		

Conclusions

Why poor operating and maintenance procedures persist in many organisations is a perplexing issue. It has been recognised for many years, with numerous guidance documents being issued to drive improvement. Lack of ownership appears to be part of the problem and no guidance (including this paper) can solve that. Engineers should have a key role in making sure good procedures are in place, especially for safety critical tasks, but they must accept the human factors aspects. Also, they need to make sure that they find time to deal with procedures, which requires them to prioritise this safety critical action over day to day production issues.

Focussing on the requirements of the end users (i.e. competent process operators and maintenance technicians) will provide a useful basis when deciding what information to include and how to present it. Trying to accommodate the requirements of secondary users is likely to diminish from the primary purpose of supporting competent people when performing tasks.

The suggestions included in this paper are intended to assist people involved in writing and reviewing procedures. Ultimately less is more and every word should count. Padding out procedures and including background information without any clear benefit to the end users should be avoided at all cost. Being ruthless with wording seems to be one of the most effective ways of creating better procedures.

Recognising that technical perfection is unachievable should help people to focus on what is important. Also, that process operators and maintenance technicians will have to identify and respond to different situations. People should not fear personal liability if an error in a procedure they wrote contributes to an accident provided the overall risk management framework is functional, based on a sensible application of the hierarchy of risk controls. Ultimately a good but imperfect procedure will provide better support to competent people performing a critical task than having no procedure due to either a reluctance to put pen to paper or delays in the writing, review and approval process.

An example of a procedure formatted along the lines discussed in this paper can be downloaded from https://abrisk.co.uk/wp-content/uploads/2024/09/ABRISK-High-Criticality-Task-Procedure-Template-01.docx

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