Deciding to stop work or deciding how work is done?

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Abstract

Stopping work when work becomes unsafe is universally considered to be a positive safety behaviour. Safety interventions aimed at building the capability to stop unsafe work have focussed on assertiveness training and creating authority to stop work policies. A recent focus group-based study found that these interventions do not necessarily capture the most common factors influencing stop work decisions, and found that stop-work decisions can be enacted in different forms. Inspired by this work, we used an ethnographic study in a water utility provider to understand how decisions to stop work were made, and how they were influenced by procedures. In this organisation, crews frequently made decisions to stop work, usually by handing over the job to another crew. The decisions were easy to make if they could be framed as finding the best way to complete the job. Operators did not view decisions framed this way as safety related decisions. Procedures could cause crews to consider stopping work, but were unlikely to actually lead to a decision to stop work. If a crew considered it impossible to comply with a procedure, the crew who would pick up the cancelled job would likely encounter the same situation. As such, stopping work for procedural requirements was not perceived as improving safety. These findings challenge the idea that stop-work decisions are best supported through procedures, assertiveness training, and authority to stop work policies. As an alternative, the results suggest that organisations can influence workers to stop work by providing alternative methods for them to complete a job which crews themselves can arrange.

Introduction

Overview

In this article, we continue the discussion started by Weber et al. (2018) in this journal, on decisions to stop work. In the safety literature, deciding to stop is considered an important. In High Reliability Organisations literature, Rochlin, La Porte, & Roberts (1987) describe how the lowest ranking personnel on an aircraft has to authority to suspend operations and how that was part of how safety was organised. From a behavioural safety point of view, Abdelhamid & Everett (2000) see workers proceeding with work, after identifying unsafe conditions, as a root cause of accidents in the construction industry. In Resilience Engineering, Woods (2006) describes organisation supporting individuals who decide to stop work for safety reasons, even if those decision turn out to be wrong, as essential for resilience. For safety climate, worker's motivation to stop work is considered an important element in the offshore industries (Høivik et al., 2009). In almost any school of thought within safety, workers being able to stop work it is considered a positive thing if workers are able to stop work that they consider to be unsafe. Accordingly, stop work

decisions are also considered difficult, as organisations employ interventions specifically designed to support workers in the decision to stop work. This support comes generally in two forms, the first is in instructions about when to stop work, usually taking form in procedures (Borys, 2012; Hale and Borys, 2013a), and second in efforts to empower workers through training or authority to stop work policies (Mackenzie, 2017; Muscatello and Heshizer, 2002; Peadon et al., 2020).

However, despite the consensus that it is important for workers to be able to stop unsafe work, and the prevalence of strategies to support stopping work, there are few studies about what it is like for workers to actually stop work. On the associated topic of speaking up for safety concerns there have been studies in aviation (Jentsch and Smith-Jentsch, 2001) and healthcare (Peadon et al., 2020), and Weber et al. (2018) who drew the net a bit wider, examined factors that support and hinder a workforce to stop work for safety. We aim to further Weber et al. (2018)'s discussion on this topic. We do this by reporting a findings from a larger ethnography within a water utility organisation. In this study, we studied work as it happened, and reflected on moments when work was stopped in any way and the influence of procedures on decisions to stop work. Our findings diverged from earlier studies in that we found that operators made decisions to stop work frequently, and did not find these to be significant events.

Instructing workers when to stop

Many organisations have safety rules or procedures that define how

work should or should not be done, and often instructions on when work should be stopped. The rationale for this practice is that workers cannot be expected to be able to predict all the consequences of their actions, and so therefore the organisation should make it clear what workers should and should not do. Through rules, organisations communicate what risk is acceptable to take, and provide a barrier against the pressure to always do more and riskier work (Hopkins, 2011). Through the rules, organisations can tell workers in what situations they should stop work. Weber et al. (2018) confirmed that there is value to this line of effort. Non-compliance can be a reason for workers to stop their own work, or to tell others to stop their work.

The different organisational views around purposes, comprehensiveness and from a procedure reflects a theoretical discussion around the role of procedures (Dekker, 2005; Hale and Borys, 2013b). On one side there is the view that procedures represent the best way to do a task, that following a procedure is a matter of simply applying if-then rules, that safety results from people following rules, and that ensuring people follow the rules is what organisations should focus to improve safety. On the other side there are studies that view procedures as a resource for action (Carim et al., 2016; Suchman, 1987) and that it always takes humans' judgement on some level how and when procedures should be applied, that it takes cognitive effort to successfully understand and apply procedures, that procedures at best can aim to be a positive influence on what operators do, and that procedures by themselves cannot guarantee safety.

The former view suggests that that the boundary between safe and unsafe work can be defined in the procedure, and that workers can apply this boundary to decide when to stop. Within this view the main challenge is that procedures are accurate and detailed enough. The latter view would look at how procedures would suggest that procedures play some role in informing worker decisions to stop work, but do not provide strict guidance for the decisions. The goal is to aid decision making and adaptation, rather than replace it.

Empowering workers to decide

Beyond instructing workers on when to stop, there are safety efforts to empower workers, so that if they judge work or a situation to have become unsafe, they can stop work. Early interventions focussed on getting workers to stop work often emphasised teaching individuals to speak up to superiors when they believe things are unsafe. This type of intervention has been most prominent and widespread in the aviation industry with crew research management training programs. Especially early crew resource management programs focussed a lot on assertiveness. Assertiveness was considered an individual characteristic, either as an attitude, a skill, or a combination of both. Some of these training programs have shown to successfully increase individuals' willingness to challenge superiors during training situations (Jentsch and Smith-Jentsch, 2001), but CRM training as a whole, however, has not been found to improve safety in aviation or outside of it (Havinga et al., 2017a; Salas et al., 2006). This lack of improvement suggests the focus on individual assertiveness (as well as the other skills trained in crew resource management) is not enough to reduce accidents.

Research on assertiveness confirmed that not only individual attributes mattered, but also the person listening, the general group climate, and organisational policies (Jentsch and Smith-Jentsch, 2001; Peadon et al., 2020). In terms of policy support, authority-to-stop-work policies are now common in many high-risk industries (Mackenzie, 2017), and often recommended and requested by regulators (Efendi, 2016; Hurwitz, 2014; Muscatello and Heshizer, 2002). These authority-to-stop-work policies involve a statement from management that work can be stopped for safety reasons. These statements are often accompanied by a required pledge or signature from workers, and possibly supervisors and managers, to stop work when unsafe conditions are identified. In practice, these policies often do more than support workers; they also create a positive obligation to stop work, and provide a way for workers to be held accountable if an accident does happen (Khalifa, 2015).

Using focus groups about decisions to stop work, Weber et al. (2018) confirmed the relevance of these factors. Some factors could vary per individual's skill and attitudes around speaking up, such as being afraid of responses from others, disagreement about safety or risk involved, and perceived credibility. Like the previous studies, Weber et al. also found that social aspects mattered. Other factors were also identified which could make individuals more or less likely to speak up, which weren't necessarily a skill or attitude, such as experience and job security. They found support for specific procedures and authority to stop work policies. These policies allowed workers to refer to such policies as the reason to stop work. In addition, Weber et al. found that more general support from management and one's team made it easier for workers if they wanted to stop work.

Research aim

This paper aims to expand the understanding of 'how are decisions to stop work made?' with the purpose to inform safety management efforts. To achieve this, the study starts with the perspective of everyday work, rather than specifically starting with safety concerns (Havinga et al., 2017b). In this perspective safety is considered to be a dynamic event (Hollnagel, 2014), where constant adjustments avoid situations becoming critical and support the achievement of successful outcomes. By investigating stop work decisions as

they happen, rather than in hindsight, this paper adds a forward-looking perspective to the literature.

The study analyses both how stop-work decisions are made, as well as when work is expected to be stopped based on procedures. Based on the finding of Weber et al. (2018) that stop work decisions can take different forms, the study counts as "stop-work decisions" all cases where a crew considers or decides to not finish a job at the originally assigned moment with the standard crew configuration. As safety procedures are a common method organisations use to try influence stop-work decisions, the procedures' influence on decisions in general is also assessed.

Method

We conducted a 3-month ethnography in an organisation to study how their Safety Management System influences frontline work and reflect on the presence of safety clutter (Rae et al., 2018) in the system. The study spanned across multiple departments within the organisation. During this ethnography, the leading researcher identified stop working as a topic worth further exploration, as he recognised that work was stopped frequently and observed operators talking to each other about this topic. After exploring whether there was enough data on this topic, we conducted an analysis specifically about stopping work.

Methodology

Our methodology is based upon the ethnographic traditions found in Safety Science, like HRO (Rochlin et al., 1987; Weick and Roberts, 1993) and Cognitive Systems Engineering (Hollnagel and Woods, 1983; Woods, 1993). It relies upon close observation of people in naturalistic settings, looks for how people make sense of their environment, and interprets actions in relation to a larger 'system' or organisation (Hoffman and Militello, 2008). We have, however, chosen to avoid framing our study in theories and concepts related to those traditions. This to stay close to our topic of study, decisions to stop work, and leave the relation between our data and conclusions as transparent as possible. In turn, we hope that this approach would make our research more accessible to researchers from other traditions and make it easier for them to critically assess our findings.

Participants

The first author studied multiple departments in the organisation. This included operational departments and support functions. In the first weeks of the ethnography, the researcher spent the most time on meeting and interviewing people from the safety team, other support roles, managers from different departments, and studying the safety management system documents. The weeks after that, the first author spent time following operational teams. Through middle management, the researcher was brought into contact with local supervisors who set up the locations and teams to visit. The researcher went out with crews maintaining the water utility network, to sewer treatment plants, and laboratory test services.

This paper mostly relies on the data that was gathered with the network responsive maintenance crews. Within this department, the researcher visited a training day, and went out with 6 crews, which included 10 different operators, in varying population density areas, shift timing, and types of teams. During these days, the researcher would talk with the crew being shadowed, as well as colleagues, contractors, and customers that were encountered during the shifts.

In the last month of the ethnography, the data was analysed, and additional information was gathered for verification purposes, and to assess questions that arose during the analysis. For this, the researcher organised interviews with people in specific roles, including supervisors and health and safety representatives.

Data collection

The researcher used observations, interviews, listening to conversations, and studying artefacts. The researcher was particularly interested in what the crews did, how they knew what to do, what crews relied upon, and what crews aimed for. The researcher would make shifts similar to the practitioners being shadowed during the day. When studying office-based roles, the researcher would attend during their regular office hours. When studying teams, like those of the network responsive maintenance department, that travelled during their shifts, the researcher would meet the teams at their depot and sit in the passenger seat in their vehicle during their shift. The researcher aimed to collect data on all roles within a team. If a team temporarily split up, the researcher would prioritise his attention to roles and expected activity based on (1) current data coverage, (2) which person was expected to most interact with elements of the safety management system, (3) and the activity that was expected to be the most interacting with uncontrolled or unexpected elements. For example, if a team split up where one was digging a hole and a second one

was going to complete the paperwork and talk to nearby residents, the researcher would generally choose to follow the later. During busy moments, the researcher would rely on observations and questions aimed at the job at hand. In between jobs, the researcher used the time to do more in-depth questioning for which there was no time during the work, as well as ask questions about work in general. During the field observations, the researcher would take notes, make schematic drawings and take pictures. Notes taken during work were aimed to be descriptive and concrete (Woods, 1993). Where the researcher wrote down things that were more abstract or hypothesis of what was going on, these were specifically marked as such. Schematic drawings were usually made of a work environment, which included the placement of equipment and job relevant factors, like water pipes. Pictures were primarily taken of work environments and (electronic) documents used. In addition to the data gathered during the field days, there were additional interviews with supervisors, area managers, and safety advisors. For this paper, five interviews were of particular interest. These interviews varied between 30 and 80 min. The interviews were almost all audio-recorded and in addition the interviewer took notes during the interview. The interviews were semi-structured and roughly set up in 3 phases; general role and responsibility, exploring difficult cases, and experience with the safety management system. As a general strategy, interviewees would be prompted to provide examples for their statements and asked to decompose their statements into recognisable cues till the researcher had the feeling he would be able to recognise the described situation if he would encounter one.

Analysis Data

Data analysis was done in multiple stages. The first step was a global analysis (Flick, 2014) in relation to the research questions of the larger project, namely about the influence of SMS elements on work. Interviews were listened to and notes were taken on the content discussed, relevant parts were transcribed in full. An overview was created to assess

whether reported facts were true, complete, and appropriate, and what themes could be explored in more detail. This was done by organising the different types of data around similar activities and concerns a single document to facilitate a surface level triangulation. In the organising of the data, primacy was given to observed actions and described events, above more general opinions and abstract statements. This was process was started while data was being collected and the researcher used these notes to determine where to focus his data collection. This was followed by an analysing of how safety management system elements influenced the activities of operational staff related to the larger project for which this ethnography was conducted. Based on the global analysis overview and the report, stop work decisions and their relation to procedures were identified as a theme where there was sufficient data for more detailed analysis. The overview also identified which procedures most came up in relation to stop work decisions or had stipulations that could require work to be stopped. This included daily vehicle pre-starts and activity checklists that existed for a set of specific hazardous activities.

From here a thematic analysis was done on stop-work decisions (Braun and Clarke, 2006). All field notes from operational teams and interviews were coded for jobs assigned, work completed, work handed over, help called in, reasons for stopping work, factors influencing stop work & continuation decisions, safety management system elements used or referred to, and conditions and actions described in procedures. This set of codes was based on the findings from Weber et al. (2018) and on the guiding questions around procedures. As the codes were only developed after the previously mentioned analyses, they have likely been influenced by our understanding of the data. Our purpose here was to establish an 'ethic' explanation (Fetterman, 2010) about when crews do and do not stop work, by understanding how crews come to stop work. In this process, we gave primacy to the crew's action and direct observations of the environment, as these actions are for which we were seeking an explanation (Atkinson et al., 2001). Based on this initial coding, we identified multiple patterns in relation to both in procedures instructing to stop work and workers deciding to stop work. In regard to the procedures, we identified activity checklists and vehicle pre-starts as relevant procedures in raising stop work consideration. Finally, we identified an overarching process of how procedures raise considerations for stop work decision was constructed. In relation to workers deciding to stop work, multiple reasons were identified and in turn verified with the use of the codes. Factors of influence was further split into general and jobs-specific factors. After the researchers had constructed and established the final set of patterns, another pass through the transcribed data was made to confirm whether any instances were found that contradicted the established themes.

Context – Water utilities network responsive maintenance

Before going into detail of the results relevant to the research question, the general setup of the organisation is discussed to provide context to the reader. The water utilities company purpose is to deliver water and sewerage services to people and businesses in their area. The department relevant to this study was the department responsible for fixing faults in the network and ensuring the network remains functioning. This includes fixing bursts of main water lines, leaks in sewer pipes, and diagnosing and fixing leaks up to where the network connects to private water lines. Besides working on pipes, their work also involves repairing interface points, such as valves and fire hydrants. Most of the work happens on or near roadways, and some of the work happens on private property. The

department has a Schedule & Dispatch [S&D] group and multiple area-based operational groups. S&D schedules and prioritise jobs, while the operational groups provide the means to complete the job. S&D combines and prioritises reported issues from internal sources and the public, before assigning them to teams from operational groups. The people in S&D are in contact with the crews during their shifts and try to assign jobs suited to the crew's capabilities, current location, time left on the shift, and fatigue levels. The operational teams are organised per area in depots. Within each depot, there are multiple teams lead by a supervisor. Teams cycle through shifts together and are made of smaller crews. These are either Multiple Purpose Singles [MPS] or Multiple Purpose Teams [MPT]. Both drive out to fix issues with the network that are assigned to them from S&D. An MPS consists of a single operator, with plumber training, and a dedicated truck with tools. Most of the MPS' jobs are diagnosing and fixing smaller leaks, often working on smaller water pipes that connect to houses. An MPT consists of two operators, one with plumber training and a truck similar to an MPS, and one operator dedicated to driving and operating an excavator. MPT tend to work on bursts on bigger pipes that run deeper in the ground. The plumber trained operators tended to be in charge of the initial planning the job and fill out paperwork.

The MPT and MPS used the identified procedures of interest at least daily and were well familiar with their content. The vehicle pre-start checks were required to be completed at the start of every shift. The activity checklists were to be completed before every job when it was expected it included an activity for which there was a checklist. There were about 4 such checklists they frequently list, although the set of activities covered by such checklists was larger. If checks or requirements on either procedure could not be met, it was expected that work was cancelled, unless special permission was granted. There are multiple ways that the operators' job is safety–critical in both MPS and MPT. Operators are exposed to many risks. Their jobs involve manual handling, the use of power tools, (heavy) machinery, and frequent exposure to traffic. In addition, water lines have pressure in them. Interface points, like valves and fire hydrants, can break and spray water under pressure. When crews work on the sewerage system, they are exposed to biochemical hazards. Older water pipes can include asbestos, providing a chemical hazard. Besides the operators themselves, operations can expose others in the area to these risks. In addition to the previously mentioned risks, operators can disconnect people from water access, which poses a risk for people with certain medical conditions. Finally, operators can damage the water infrastructure during their work, which in turn can create spills and other disruptions.

Results

The results first discuss the influence of procedures, examining the effects of efforts that are intended to influence stop work decisions. Next, the data on stop work decisions made or considered by workers are discussed.

Instructions about stopping work

The MPT and MPS interact frequently with two types of procedures, "activity checklists" and "vehicles pre-starts", that capture how certain activities should be done. These procedures have foremost been designed to instruct workers in how work should be done, but also imply that work should be stopped if the requirements cannot be met. Both procedures are discussed below, starting by a general description and followed by a description of their use.

Activity checklists

The organisation had checklists for common hazardous activities. For each of these activities in a job, the crew was required to individually mark the presence of each hazard control for each phase of work. In all crews, when completing the checklists, the (leading) operator would go through the checklist from top to bottom on a tablet-like computer before starting a job. Crews used the same checklists frequently, and were familiar with the items on these lists. All, but one, of the studied crews mentioned that there were items on at least one of the checklists they filled that day that they considered impossible to do. Some crews marked off the impossible items, some left the items blank, and some put crosses next to the items. Variation between the crews on which items were considered impossible is explained primarily through different interpretation of ambiguities in the checklists. For example, crews had a different understanding of when tools and equipment counted as "machinery", and when an operator counted as an "authorised person" for the purpose of the checklist. These differences in interpretation did not influence the performance of the work. Crews who completed the checklists differently still took similar actions to complete tasks. When the researcher prompted the crews to talk about the impossible items, the crews appealed to the necessity of performing the task in a certain way, and to the standard set of tools available to crews. In other words, it was the view of the operators that the items were impossible for all crews, not just for this particular crew at this particular time. Stopping work would not have led to the work being done differently or under better conditions.

The researcher observed only one case of a checklist leading to a crew stopping work. This was regarding a job inside a rail corridor. Before the crew left the yard, one crew member already seemed concerned about the location and mentioned to his colleague 'that one [that job] might be on the train lines'. The researcher drove with that operator to the job location. After verifying the details and exact location, it became clear to the operator that the job was indeed inside a rail corridor. He called S&D and his supervisor and told them 'The job is inside the rail corridor' and let them know 'we need a rail observer to do this job'. The operator had not opened the checklists before or after he had made these calls. The researcher later confirmed that this requirement was on the activity checklist for working inside a rail corridor. Unlike with other checklist items that were considered impossible to comply with for any crew, this requirement could be met by additional planning, and then the crew assigned this job would be able to perform the work under safer conditions. Overall, this shows a process where checklists do influence the controls that crews considered; an influence that was sustained even if the checklist was not specifically consulted for that job. However, the crew's reading of the checklist items did not dictate how a job was done. This is evidenced by the fact that crews performed the job similarly, even if they had a different understanding of the items on the checklist. Checklist items could lead to stopping work, but rarely in fact did, as their requirements would apply equally to whenever or by whomever the job was continued, as they would encounter the same conditions.

Vehicle pre-starts

Crews were expected to complete pre-start inspection checklists before starting their vehicle for the first time every shift. These checklists included checks (items to inspect) and minor maintenance actions. MPS had a pre-start for their truck, while MPT also had pre-starts for the trailer and excavator. All items of the pre-start had to be completed and all

checks passed. If any check was not passed, the policy required either that the issue be resolved, or that special permission be granted to continue to use the vehicle. It was, however, difficult for crews to do a thorough pre-start for every shift. The main factors that made it difficult to make a pre-start difficult were:

- Time: Crews mentioned that doing all the checklists thoroughly would take too long. One operator mentioned that doing all pre-starts thoroughly could take 2 h from an MPT. Crews mentioned that this would reduce their active work time by too much, and lead to comments from supervisors and S&D.
- Skill: Crews mentioned that they lacked the skill to do all the checks properly. Crews mentioned that they could inspect some items only superficially and that they were not confident that their judgement was a good indication that the item was truly in a good condition.
- Possibility for action: Crews mentioned that it was impossible to take actions based on the pre-start checks. One example was inspecting the trailer and excavator for debris and cleanliness. Crews would ideally take action on this straight away, but in the depots there were no facilities to clean the vehicles and going somewhere else was not considered feasible to do daily.

In most of these cases, delaying work would not be a solution and considered an option. Some crews mentioned that they would delay some checks or actions till they were at their first job and unpacking their equipment, like doing some cleaning at their first job site. Overall, crews judged the value of the pre-starts in relation to how they would affect work. Crews generally considered the items on the pre-start relevant and constantly went back and forth between their pre-start lists and the check vehicle while conducting the pre-starts. The items which did take especially long, required more knowledge, or were difficult to address, were not always done with the same attention or thoroughness. The view was that completing a pre-start (in-depth) would not lead to a different result, other than losing out on time for other work. Crews cared more for the consequences of their actions, rather than following instructions from the pre-start.

Workers deciding to stop a job

Despite the apparent lack of efficacy of the formal processes supporting decisions to stop work, stopping work was not necessarily a difficult or even significant decision for operators. Stopping work was not seen as a safety-specific activity, but as a normal part of completing work. This section starts with a review of the frequency of stopping work, moving to the reasons for stopping work, and then the factors hindering and helping stopping work.

Frequency

Crews stopped work frequently. This was confirmed through direct observation, as well as conversations with and between operators. Work was usually stopped by handing a job back to S&D, with additional information about the job and what was needed for the job. In terms of Weber et al. (2018), this was “transferring” unsafe work. Of the MPS jobs observed, almost half of the jobs at least part of the job was handed over to another crew, and multiple of those jobs were handed over without any work on them being done other than a visual inspection of the job area. For MPT, a similar portion of jobs were handed over without out any work done to them, but there were no jobs that were only partially

completed before being handed over to another team. Of all days observed, more than half included one or more jobs where work was stopped. Stopping work was more common for MPS, but MPT still would experience this more than weekly on average. New operators in the company would talk to each other about what they learned about when to hand over certain type jobs, and more experienced operators shared stories about cases where they completed jobs that they normally would have handed over. Especially for MPS, learning when to hand over a job was considered part of learning how to fulfil their role.

Reasons

There were a variety of reasons why crews stopped jobs, but all of these related to how the work was best done from the crew's perspective, or the customer perspective. For all the jobs directly observed by the researcher that were not completed:

- the job was easier if done with equipment or tools the crew did not have with them;
- the job was easier if done by a bigger crew; • the job was expected to take longer than the operator's shift would last;
- the job would require a large group of customers to be cut off from water during a water critical period of day (e.g around dinner time); or
- the job was inside a rail corridor and no railway observer was arranged as required.

These reasons were explicitly provided by the operators, and were confirmed by the researcher by:

- comparing the situation with the reason provided;
- checking whether crews in similar situations (according to the reasons provided), made similar decisions; and
- analysing whether the decision moment was close to the moment the relevant information became apparent to the crew.

Of the reasons provided for stopping work, only the rationale that the job was easier if done with equipment or tools that the crew did not have with them was not reliably confirmed. In one case an MPT was trying to find a blockage around a house and was working with a truck with older equipment. One activity the crew was considering had potential to damage pipes around the house, and teams with the newer equipment could bypass this activity. The crew considered whether they should hand over the job but decided to continue working after adjusting the plan to minimise this risk. This case confirmed that suitability of a crew's tools, compared to the suitability of another crew's tools is a factor in stopping work, but also showed that this does not automatically lead to the decision to stop and hand over a job.

Interviews with, and discussions among operators confirmed the above reasons, and also elicited further reasons for stopping work. Operators new to the organisation would talk to each other about jobs that they had stopped, jobs that they believed they should have stopped, or rules-of-thumb that they relied upon to make such decisions. Through these sources other reasons for stopping work were mentioned:

- avoiding noisy work at night if there was potential to wake people up;
- avoiding long, but non-urgent jobs that cannot be stopped halfway, without first confirming with schedule & dispatch whether it is okay for the crew to be occupied for a long time;
- being fatigued; and • not being able to diagnose the problem or solve the issue

These reasons could not be verified through direct observation, but are consistent with the general pattern that crews make stop-work decisions by comparing the current conditions of work with future alternatives.

In some cases, when S&D assigned a job, both S&D and the crew believed that there would be a high likelihood that the job would be handed back to S&D before the crew had even arrived on the job. S&D relies on jobs called through by the public, which means that reports are made by people without expertise on the topic, not knowing what they are exactly looking at, and often lacking a vocabulary to describe the issues. As such, there is always some uncertainty for S&D and the crews about what is needed for a job, and some job descriptions are so vague that it is expected the first crew send out is not setup correctly to complete the job. A crew might be able to perform the work immediately, but likely will only be able to scope the work to allow additional arrangements, such as arranging traffic control or bringing specialised equipment, to be made. In these cases, transferring the work is the expectation, and completing the work is the exception.

Helping and hindering factors

Beyond specific rationales for stopping work, other factors were identified that influenced decisions to stop work. These have been split into general factors and job-specific factors below.

General factors

The research identified multiple general factors that influence decisions to stop or continue work. These factors are general in the sense that they are not an immediate feature of the job at hand, but they can change between teams, depots, or over time. The most frequently brought up element was whether people listened to operators concerns. As one practitioner shared:

> *"Zero harm is a motto. It's just a thing that people say, but stopping when you don't feel safe is actually how we do things. If you don't feel like something is safe, you can stop and ask for help, and people take you seriously. It might not be possible for someone to immediately help you out, but that you stop and are concerned is taken seriously."*

That operators could stop in this organisation and would be listened to was brought up as a general trend, but also in relation to specific issues, like fatigue. Operators mentioned that not everyone might stop work for fatigue in all cases, but operators knew that operators had stopped worked for fatigue in the past, that people listened to them, and that these operators did not get punished for this. Decisions to stop work were also made easier by the frequency with which jobs are handed over. Neither crews, supervisors, nor S&D expected that all assigned jobs could be done. Crews would inform S&D about how they saw the job and what would be needed to complete the job, and they did not need to convince anyone of their assessment. Crews did not have to justify their stop-work decisions (Weber et al., 2018), taking away a factor that could hinder individuals. Stopping a job did not make an operator stand out or even lead to questioning of their decision.

Another factor that operators mentioned was that stopping work drains resources away from elsewhere in the organisation. Not completing a job creates additional strain and production pressure on themselves and colleagues, and the network's functioning, as someone would have to go out again to complete that job. This reason was brought up most

frequently by crews from the most remote depot studied, where it was more common for them hear what happened to a cancelled job. At the depot, teams would talk about difficult jobs they had received and ask about jobs that they had handed over. The costs to the organisation and the persistence of the issue that the cancelled job was intended to fix was most visible to these crews.

Job specific factors

There were also job-specific factors that can influence a crew's decision to stop work. These factors were not present for every job, nor were necessarily enough to cancel or continue work, but they could provide a push in either direction.

How the job related to the service provided to customers influenced a crew's willingness to stop work. A leaking water meter or a small pipe could create a wet patch on the grass, without affecting the water supply to customers, making it not too bad to stop that job. If a job affected a customer's water supply, operators felt more pressure to continue work. This was related to that workers viewed their work in terms of serving the public. This showed in how crews talked about time pressure when water was turned off but showed even stronger in their actions. When having to dig for pipes, it was common for crews to carefully cut out and lift patches of grass, so the grass could be returned intact after the job was done. In case of faults that were not clear-cut or would show inconsistently, like (slightly) lowered water pressure at a resident's house, crews would continue work based on the customer explanation and their knowledge of what a well-functioning water service looked like. Crews were observed to continue work under uncomfortable conditions after residents were happily surprised by the results so far, and their activity went beyond the originally assigned job, because they believed the water service should be functioning better for the residents.

Another factor that influenced a crew's willingness to stop was whether a job would create additional work or risks. If a hole was dug to uncover a pipe, crews did not like leaving until the job was completed. This was considered inefficient at an organisational level and potentially dangerous. Either the hole had to be filled first and be dug out again by the replacing crew, or the hole had to be left open, creating a hazard for the public. When crews encountered major leaks which flooded part of a street, crews showed more concern to take action.

The final factor identified was the availability of replacement crews. If no replacement crews were available, this created a push to continue a job at hand if it was urgent. In most situations, if a crew was not ideally set up for a job, the crew would hand over the job to a crew that was better equipped for that job. However, if the job was urgent, and no replacement crew was available, the crew would continue working on the job. Decisions to continue would be made in consultation between the crew and S&D, as S&D would know about the availability of other crews.

The general factors and job-specific factors that promote or hinder stopping unsafe work all refer to a larger view than the procedural requirements and situation at hand. This includes consequences for the public, goals and efficiency of the organisation as a whole, and the acceptance and response from others in the organisation.

Discussion

Safety researchers from many schools of thought, including ourselves, have considered workers stopping work in unsafe or degraded conditions as important for safety. Such decisions can steer work away from failure and degraded conditions. As the discussed cases show, a decision to stop work can allow for jobs to be completed with better and safer equipment, source extra resources to mitigate specific hazards like traffic, and avoid workers being stuck on a job while fatigue starts to develop. All things we would consider good for safety. However, this is not how workers primarily think about decisions to stop work. We recognise three importance differences in how the literature characterises stop work decisions and how front-line workers in this study approached stop work decisions.

The (lack of) significance of stop-work decisions. For the crews in this study, deciding to stop work was not a big event. These decisions were made daily and learning when to stop work was considered part of learning to be a good operator. This insignificance of stopping work might not be true for every organisation, or for every moment within one organisation, but these findings show that it is not necessarily the case that stopping work is an unusual and difficult decision. This is at odds with the idea that operators need training or explicit policy support (or require) workers to make stop work decisions. Instead, it raises the question if work situations can be deliberately designed to make stop work decisions more routine and feel less significant.

Stop work decisions are about how work is done. Operators did not think about the decision to stop or not stop work as an endpoint. 'Stop-work decisions' were considered as a possible additional step towards completing the job. The consequences of this step were considered in relation to the organisation's effectiveness and efficiency. The operator's view here differs from the point of view of stop-work related safety interventions, like policy and training, which see a (correct) stop work decision as the end-point, at which ideally safety is achieved. Our study highlighted that when a crew decides to stop work, that work does not disappear and that work has to be completed at another time, possibly by another crew. The worker's view here is more accurate in terms of its consequences on safety when taking a long-term organisational perspective.

Procedures spark considerations but do not dictate actions. There were indications that procedures influenced what operators considered, but operators would, in the end, base their actions on what they considered the best way for the organisation to complete the job at hand. In our study, procedures often provided an insufficient answer for that purpose. Limitations provided by procedures would usually apply equally to other crews, making it unlikely that stopping work because of procedural limitations would lead to work being conducted in a safer manner. This finding fits with the idea that procedures are best seen as a resource for action and always require interpretation.

These differences do not change whether decisions to stop work are relevant for safety, however, it changes our understanding of what influences workers to make such decisions.

Practical implications

As with any case study, it is difficult to assess the generalisability of these findings. However, since stop work interventions have had limited success, our findings provide a possible explanation for previous results. If stop-work decisions are common and considered part of work normal work, it is unlikely that workers need specific training to encourage stopping work, or policies that give permission or instruct workers to stop unsafe

work. Procedures can create points of reflection for workers, but when no better alternative is available, procedures are unlikely to lead to the decision to stop work. This suggests that procedures by themselves are not enough to make people stop work.

The results also point to an alternative strategy: try to make any stop-work decision feel normal and part of everyday work. By influencing the factors that make stop-work decisions less like significant events and more like part of everyday work, organisations can create conditions in which stop-work decisions are made more often for safety purposes. One option is to involve operators in scoping and planning activities, and making task adjustment a legitimate option for them to suggest as part of their regular work activities. A second option is to make stopping, or handing over, work part of the regular training and mentoring. As the findings suggest, knowing when to stop or hand over work is closely related to the specific understanding of task, and would reinforce that stopping work is expected. The third option is to focus on presenting crews with alternative options for how an organisation can achieve a task. This could be by describing alternative courses of action in procedures if requirements cannot be met, or by creating specialised resources or teams to deal with specific situations, that crews know they can hand work over to. This shows workers that the organisation expects such tasks to be completed by handing over work.

The relationship between stopping work and safety theories

In this paper, we investigated and characterised a specific workplace behaviour — stopping and re-arranging work. It is very tempting to extrapolate from our findings on this behaviour towards broader theories of organisational safety. As mentioned, many theories of safety cite stopping work as a behaviour that is important, if not central, to the theory. We suggest that extrapolating from individual behaviours towards broad theories, and vice versa, should be done with caution, and in a limited fashion. We subscribe to the view that we should first describe thoroughly, then build theories once we have enough well-grounded descriptions (Rae et al., 2020). With that caution in mind, here is how we see the work potentially connected to existing theories:

Safety Culture

There are three angles through which our findings connect to safety culture research:

- Safety culture research often emphasises the value or priority given to safety, which is then linked to a willingness to stop or de-prioritise work (Høivik et al., 2009). In this study, the ability to stop work seemed mostly about a reflecting on how work was best done and not an immediate product of how much workers value safety, as some safety culture research tends to emphasise. However, what a worker will consider the ‘best’ way to complete a job, will likely depend on how they value safety.
- Safety culture research has studied the idea of the openness in communication, which is linked to people’s willingness to discuss errors made and raise issues (Wagner et al., 2013). Some of the workers’ comments do suggest that there was a general openness to talk about considerations to stop work. However, is it unclear whether ‘openness’ was a driving factor in workers’ ability to stop work, as workers did not put a lot of effort into raising issues or explaining why things couldn’t be done in those situations. Information the operators communicated to S&D about stopped jobs was more focussed on informing what was needed for the next crew to complete the job, than on explaining the issues they ran into. In addition, the fact

that crews considered some procedural requirements impossible to comply with, and made different interpretations of procedures, is an indication that not all issues were being raised and collectively discussed. It is more likely that trust between groups and the operators not having the need to justify or discuss every event in detail contributed to the ease with which work was stopped. More research is needed to explore whether this lack of discussing and describing reasons to stop work truly contributes to willingness to stop work, and whether this opposes 'openness' in communication.

- The relation between power and safety has recently become a more prominent topic within safety culture research (Antonsen and Almklov, 2019). It is clear from the study that crews had the power to stop and hand work back to S&D. However, this power does not seem to be closely related to any social hierarchy, as in the power of one person to make another person do something, or a person influencing what are legitimate options for another, two common dimensions through which power is viewed in this type of research (Antonsen and Almklov, 2019). The crews' power comes largely from having the most direct access to information regarding the nature and state of the job. As there was no comparison material or indications of situations where crews had more or less power, it is difficult to draw any meaningful conclusions in this area. On top of that, with the geographically spread out nature of the work, it is difficult to imagine a type of organising where the workers would not be in this position.

High Reliability Organisations [HRO]

On first sight, the study seems to align with the ideas of deference to expertise and mindfulness, which originated out of HRO (Weick and Sutcliffe, 2007). The ability of the frontline experts to stop a job was central in the development of HRO theory (Rochlin et al., 1987). Where our findings differ is that the process of stopping work did not seem to represent a preoccupation with failure, and instead, was better characterised as a search for a pathway to success. While an interesting difference, it is difficult to generalise anything from this discrepancy. Not all organisations are considered HROs and it is very likely all organisations have processes for both a preoccupation with failure and processes that are a search for success.

Resilience engineering

In regards to Resilience Engineering and Safety-II, the findings very much support the description of safety as a dynamic event (Hollnagel, 2014). People constantly adapt to the situation and to each other to make things run effectively and efficiently, while preventing unwanted events. Stop work decisions are one of these constant adjustments and they are considered part of work, rather than a safety effort separate from work. The efforts of the procedures can best be seen as attempts to guide adaption (Provan et al., 2020). The reasons for which work was stopped had the potential to affect safety, but the primary reasoning around the adaptations was in terms of the work processes and goals.

Behaviour-based safety

The study challenges behaviour-based safety in relation to its view on procedures. As Hale and Borys (2013b) identified in their review on rules, behaviour-based safety is often associated with an if-then rule-following model of procedures. The findings of this study

support the view that procedures always need to be interpreted and function as a resource for action, opposing this if-then rule following model. In the studied situations, procedures raised considerations and helped set norms, but do not dictate actions, even after the procedures were interpreted in a certain way. In addition, while our findings do not directly contradict the behaviour based safety view that continuing work after a procedure breach is a root cause of incidents (Abdelhamid and Everett, 2000), our findings do challenge the usefulness of universally classifying procedure breaches that way. If stopping work for procedural requirements is likely to lead work to be conducted at a different time or by a different crew under similar conditions, managing stop work decision by procedure breaches is unlikely to be a fruitful endeavour.

Conclusions

Our findings challenge the idea that stop work decisions are considered as important and difficult safety decisions by front-line workers. We found in the studied organisation that workers make these decisions all the time and instead view them as finding a suitable way to complete work, rather than stop work for safety reasons. This as work there was always thought for how work could be completed in better conditions. Procedures were linked to crews considering stopping work, but procedures were unlikely to actually lead to a decision to stop work. If a crew considered it impossible to comply with a procedure, the crew who would be sent to the cancelled job next would likely encounter the same situation. As such, stopping work for procedural requirements was often not perceived as helpful. These findings challenge the idea that stop-work decisions are best supported through procedures, assertiveness training, and authority to stop work policies, as these interventions suppose that stop work decisions are experienced as difficult and significant by workers. An alternative strategy to make it more likely workers stop work in dangerous situations would be for organisations to provide alternative methods for workers to complete a job.

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