Transport Accident Investigation Commission

Final report

Marine inquiry MO-2018-205
Fatality on board the factory trawler San Granit
14 November 2018

June 2020

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas.

The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. It is not the Commission's purpose to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. However, the Commission will not refrain from fully reporting on the circumstances and factors contributing to an accident because fault or liability may be inferred from the findings.

Figure 1: The *San Granit*
(credit: Sanford Limited)

Figure 2: Location of accident
(credit: mapsof.net)

Contents

Figures

1. Executive summary

1.1. During the early morning of 14 November 2018, the New Zealand-registered deep-sea factory trawler *San Granit* was engaged in trawling about 55 nautical miles (102 kilometres) east of Banks Peninsula.

1.2. At approximately 0350 a deckhand who was working on the factory deck went to talk to the freezerman. The deckhand approached the working area forward of the freezers and noticed that the freezerman was trapped in a piece of machinery known as an accumulator. The deckhand immediately notified the factory supervisor, who in turn notified the bridge and then the master.

1.3. The ship's medic arrived at the scene and with assistance from another crew member removed the freezerman from the accumulator. The medic conducted a primary assessment of the freezerman and determined there were no signs of life.

1.4. The vessel immediately returned to port and arrived in Timaru at approximately 1600 the same day.

1.5. The Transport Accident Investigation Commission (Commission) **found** that the freezerman became trapped in the accumulator and received fatal injuries. The Commission was unable to determine why the freezerman entered the guarded area, but it may have been to clear a jammed box of fish.

1.6. The Commission also **found** that the freezerman's blood methamphetamine level indicated that it was virtually certain that methampthetamine had been consumed whilst at sea. Due to the varying effects this substance has on an individual, it was not possible to determine whether it contributed to the accident.

1.7. The Commission identified two **safety issues**:

- the risks associated with operating the accumulator were not fully understood and the safety controls relied heavily on the machine operator following generic instructions and procedures
- the training in place for the crew around the configuration of the emergency stops likely resulted in confusion on which emergency stops serviced which system.

1.8. Sanford Limited (the owner/operator) has since addressed the risks of operating the accumulator by conducting a full safety assessment of the automatic plate freezer area on board the *San Granit*. It has also implemented engineering controls to mitigate a person's risk of becoming trapped within the accumulator. The Commission believes that this safety action addresses the first safety issue and therefore has not issued a recommendation.

1.9. However, the Commission is concerned that crew members of the *San Granit* may not have received appropriate training in identifying which emergency stop to use for which system. Therefore, the Commission has made a **new recommendation** that Sanford implement training for the crew on the configuration of the emergency stops to avoid confusion on which emergency stop services which system. This will reduce the likelihood of crew accessing running machinery after pressing an incorrect emergency stop.

1.10. The Commission **repeats** one **key lesson** made in a previous report:

- it is not acceptable under any circumstances for workers to be affected by performance-impairing substances, regardless of what roles they are performing.

1.11. The Commission identified one **new key lesson**:

- carrying out a task analysis on any piece of machinery is an important safety function that helps to identify foreseeable hazards associated with its use and identify best practicable control measures that can be introduced to reduce the risk to operators. When it is not possible to eliminate an identified hazard, a task analysis will help to ensure robust operating procedures are in place, which in turn will assist in the development of future user training requirements.

2. Factual information

Narrative

2.1. The *San Granit* was a New Zealand-registered deep-water factory trawler[1], owned and operated by Sanford Limited. In November 2016, after relocating from Norway to New Zealand, the vessel had undergone an extensive refit and entered the Marine Operators' Safety System administered by Maritime New Zealand. Following a shakedown[2] voyage in December 2016, the *San Granit* had become operational.

2.2. During the early morning of 14 November 2018, the *San Granit* was engaged in trawling approximately 55 nautical miles (102 kilometres) east of Banks Peninsula. The sea was slight and there was little wind.

2.3. Shortly before 0100, the crew on the 0100-0700 shift made their way to the factory to take over from the 1900-0100 shift. In the forward part of the factory deck, known as the freezer area, the freezerman whose shift was finishing handed over to the incoming freezerman at approximately 0045.

2.4. At approximately 0350 a deckhand who had been working on the factory deck went to the freezer area (see Figure 3) to talk to the freezerman. When the working area forward of the freezers came into view, the deckhand saw that the freezerman was trapped in a piece of the machinery called the accumulator. The deckhand believed that the freezerman was deceased and immediately left to inform the factory supervisor. In turn, the factory supervisor sent for the factory manager and the medic and told the remaining factory hands to leave the factory. The first officer, who was the officer of the watch, was informed of the situation and promptly called the master.

[1] A fishing vessel fitted with factory equipment for processing, packaging and freezing fish products.
[2] A preliminary trip during which adjustments can be made to improve a vessel's functionality and efficiency and bring it to a satisfactory state for entering its operational phase.

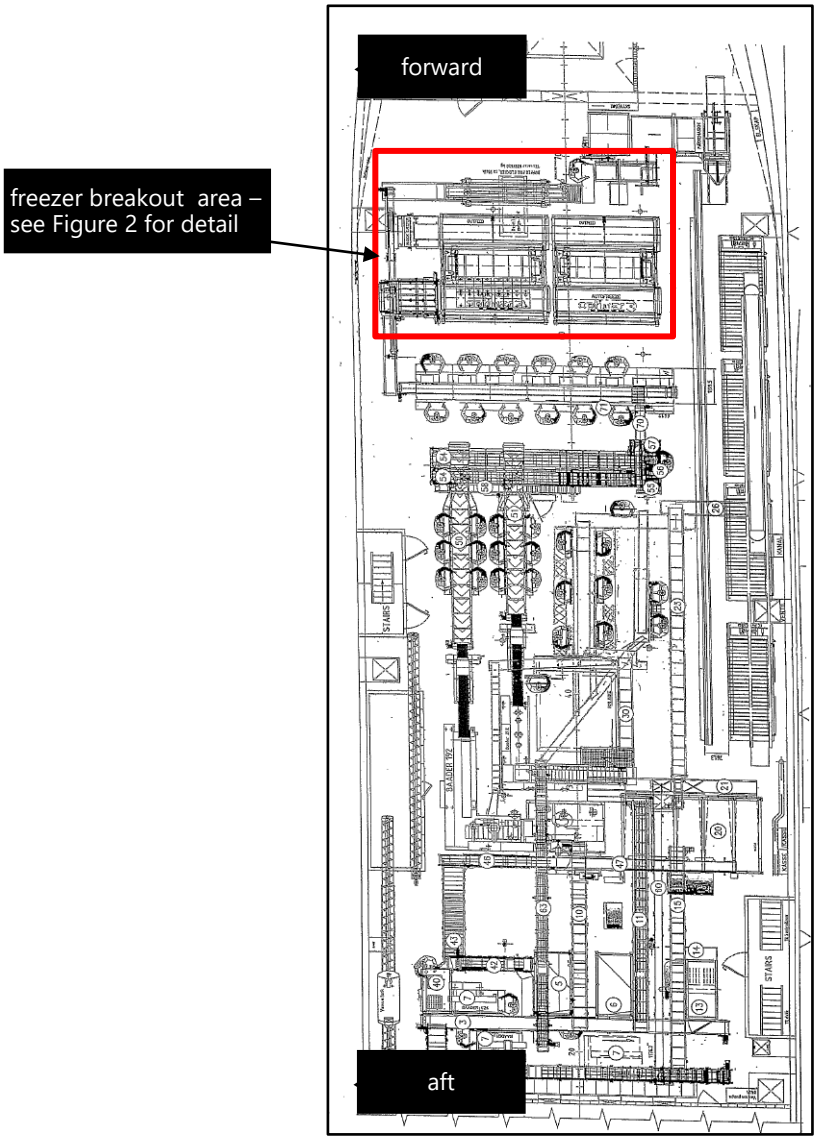

Figure 3: Factory plan for the *San Granit*

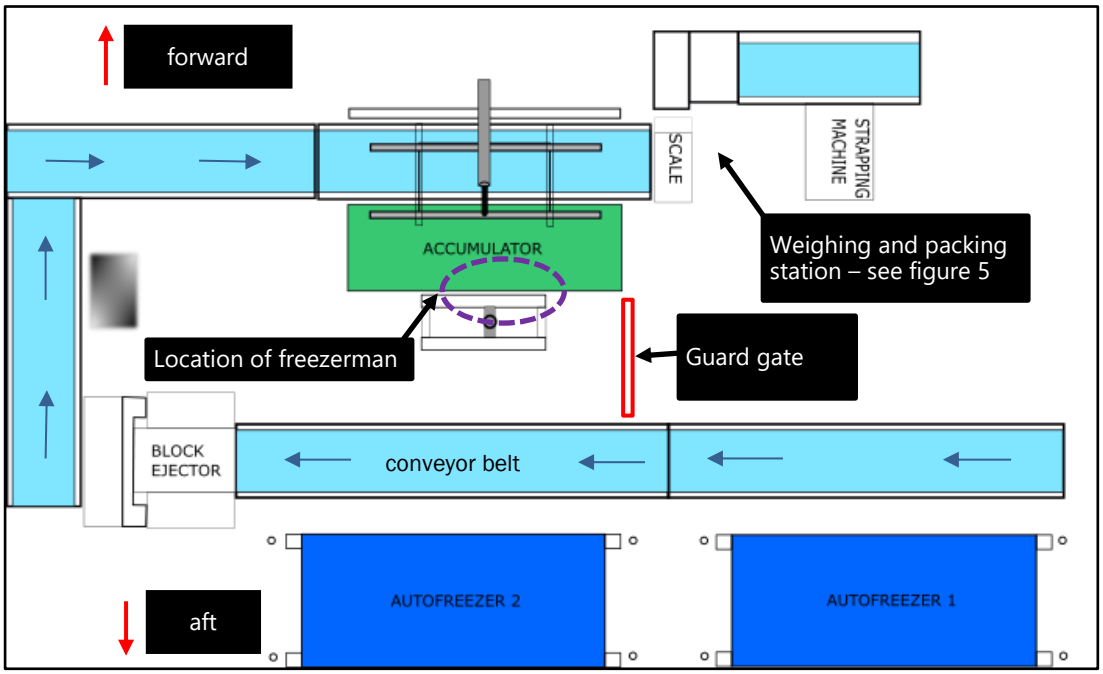

Figure 4: Layout of the freezers and freezer breakout area on board the *San Granit*

2.5. The second officer, who was the ship's medic, arrived at the scene and carried out an initial first aid assessment of the freezerman. The initial assessment was that there were no signs of life; however, the position of the accumulator made the medical assessment difficult. The second officer and the factory technician removed the freezerman from the accumulator and carried out a more thorough assessment before confirming that the freezerman was showing no signs of life.

2.6. The net was hauled in, the catch was discarded, and the *San Granit* headed for Timaru, arriving at around 1600 the same day.

The *San Granit*

2.7. The *San Granit* was one of 12 freezer factory vessels operated by Sanford from its Timaru-based deep-sea fishing fleet. Originally built as the *Juvel* and later named the *Granit IV*, the vessel had been purchased from a Norwegian fishing company in 2015. Following a survey in 2016, the vessel had been transferred to the New Zealand flag and renamed the *San Granit*.

2.8. The *San Granit* had arrived in Timaru in the middle of November 2016. An extensive refurbishment of the factory had been undertaken, which included the installation of fish-processing machinery more suited to the species of fish being targeted by the Sanford fleet. The conveying, packing, weighing and labelling equipment forward of the automatic plate freezers, which included the accumulator, had not been significantly changed (see Figures 4 and 5).

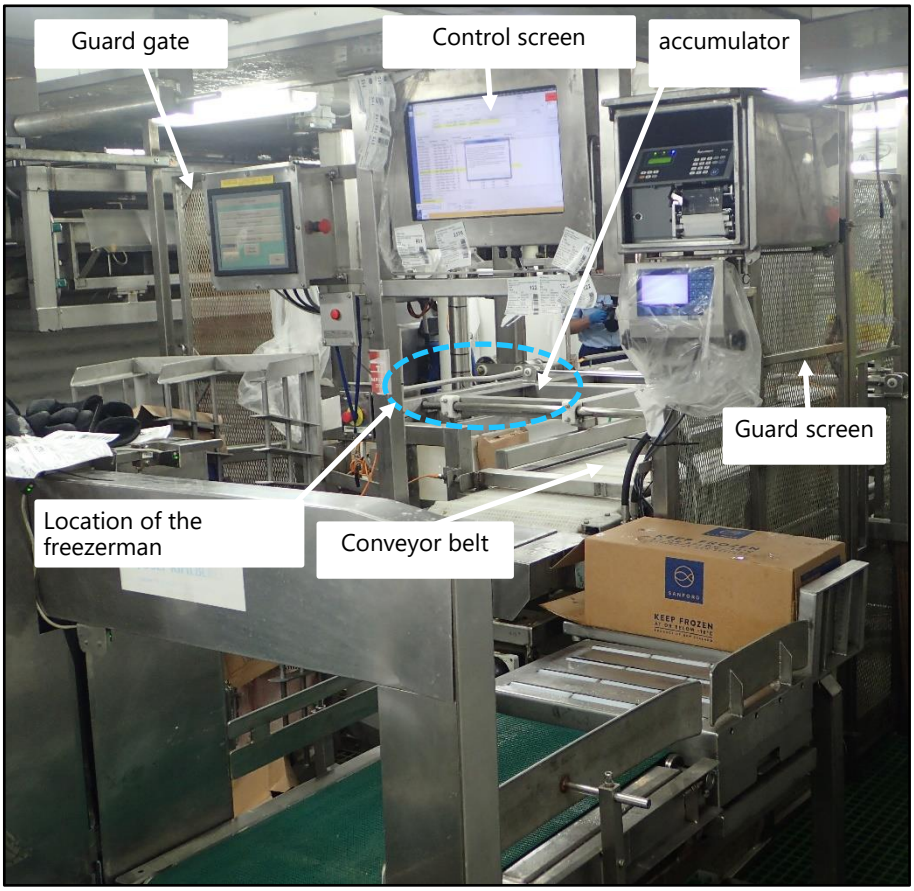

Figure 5: The weighing and packing station forward of the automatic plate freezers on board the *San Granit*

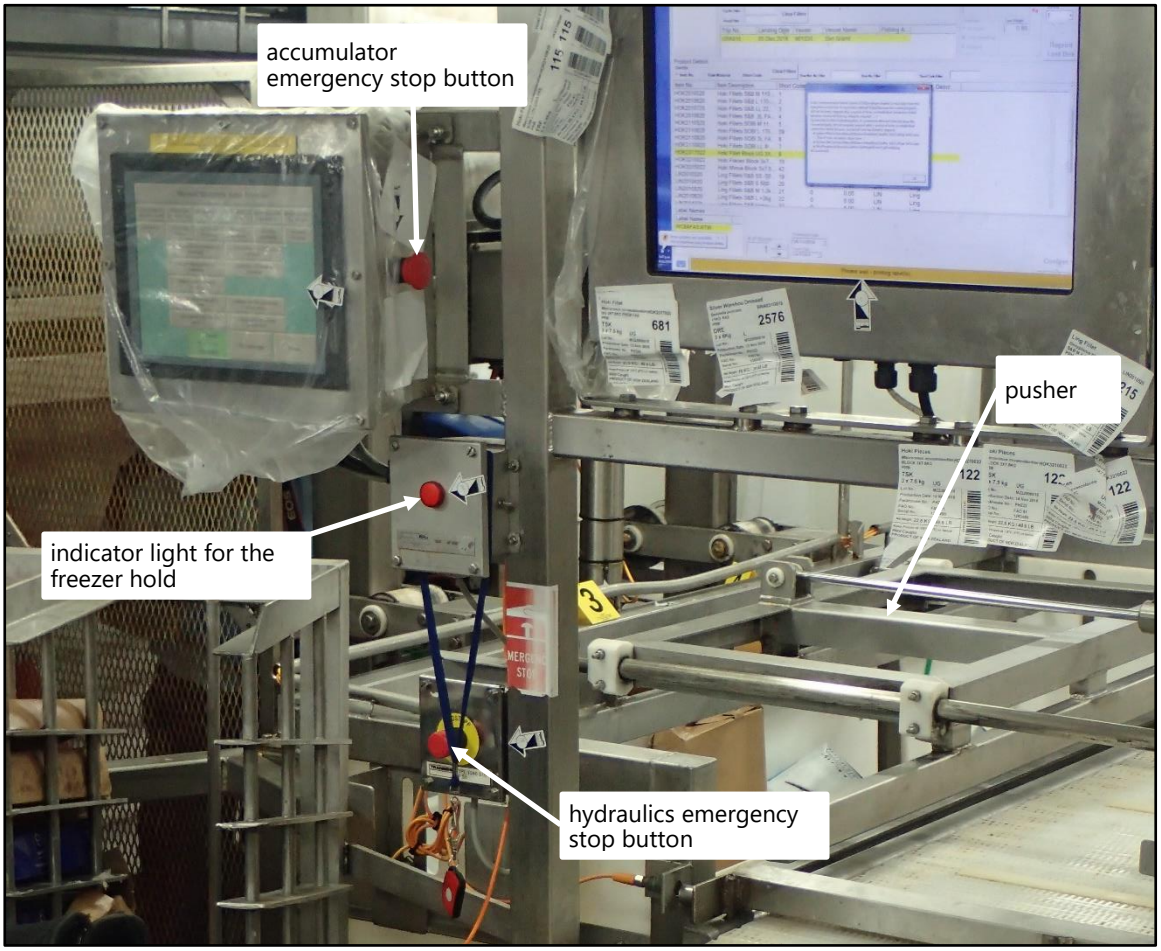

Figure 6: Control screens and emergency stops at the weighing and packing station

Factory safety assessments before entering service

2.9. In preparation for entering service, an initial safety inspection had been carried out by an independent safety company in November 2016. At that time the factory had not been in an operational state, and therefore the inspection was unable to determine the risks associated with running machinery. The safety company had subsequently made a number of recommendations in a safety assessment report provided to Sanford.

2.10. One month later, the same safety company had returned to assess the status of these recommendations and assess the risks associated with running machinery. However, the factory equipment had still not been operational. As a result, a safety advisor had sailed on board the *San Granit* for its shakedown trip to assess the machinery being used in its operational state.

2.11. Two further safety assessment reports had been provided to Sanford as a result of these assessments. Generic risk assessments and safe operating procedures had also been supplied to Sanford to help develop vessel-specific risk assessments and safe operating procedures. The *San Granit* had become fully operational in January 2017.

In-service factory safety assessments

2.12. During 2017 factory operations had been refined; however, safety measures for the automatic plate freezers had been proving difficult to establish. On 1 December 2017 the skipper had submitted a system improvement notice through the company's electronic quality, health, safety and environment management database. The notice

had requested that the company "review [the] guarding and lockout mechanism on [the] Automatic Plate Freezers to determine [the] best workable solution".

2.13. In December 2017 the safety advisor who had sailed on the shakedown trip had attended the vessel to help the company establish the best workable solution for fitting protective guarding around factory machinery. As a result, the company had planned to fit interlocks on the ring-fence guarding around the automatic plate freezer, but due to operational issues, such as freezer trays jamming, it had been decided that further consideration was required before they could be fitted. A subsequent report produced by the safety advisor had stated that:

> Fitting interlocks to the AS:NZ standard on the safety cage should be the goal once operational issues are resolved but only if deemed reasonably practicable considering the final operational reality of the equipment.

2.14. Eventually the automatic plate freezer controls had been moved outside the guarded area so that the equipment could be adjusted without the need for personnel to enter.

2.15. Minutes from the ship's onboard environmental, health and safety (EH&S) meeting held in April 2018 showed that there had been ongoing, trip-by-trip improvements made with regard to the automatic plate freezer guarding. By June 2018 the references to outstanding guarding had been removed. The system improvement notice had been closed in the database and annotated "it is not deemed reasonably practicable to fit interlocks".

The accumulator

2.16. The accumulator was a large tub that sat to the side of the conveyor line running from the freezers (see Figure 4). It was effectively a storage area that could be automatically loaded with up to 80 boxes when boxes were being conveyed more quickly than they could be processed.

2.17. Sensors detected when the adjacent conveyor belt was full before the boxes were pushed into the accumulator. Another sensor detected the presence of boxes inside the accumulator and activated a hydraulic ram, which moved the floor down to make room for the next row (see Figure 7).

2.18. When an operator was ready to resume packing, weighing and labelling the stored boxes, they could select the 'unload accumulator' function on a control screen. The reverse process was used for unloading: the pusher moved over the accumulator, the floor was raised up one row and the pusher moved the row of boxes back onto the conveyor belt for delivery to the weighing and packing station.

2.19. The accumulator was considered more a part of the conveying system than an independent piece of equipment. It was not allocated an asset identification number in the operator's maintenance system, there was no manufacturer's identification plate on it, and there were no manufacturer's operating instructions available.

Training

2.20. All the crew had been provided with a set of safety induction handbooks as part of their company and shipboard familiarisation. The Introduction to Safety On-board handbook included a section on the safe use of machinery. This section included instructions to "never put your hands in the machines while they are running" and "never try unblocking a machine while running". Additionally, the safe operating procedures for the factory equipment, which were either machine specific or area specific, provided further information about the risks in, hazards in and safe operation of the factory.

2.21. Training in the safe use of the accumulator was provided through a demonstration and supervision by an experienced operator. It was backed up by the generic safety instructions and safe operating procedures. The accumulator was only to be operated by a factory technician or a person appropriately trained as a freezerman, and who demonstrated a thorough knowledge of the safe operating procedures.

2.22. The freezerman involved in this accident had been signed off as competent in all aspects in May 2018. This had been the freezerman's third trip on board the *San Granit*.

Figure 7: Hydraulic ram at the back of the accumulator, which moves the floor up and down (credit: Maritime New Zealand)

Relevant health and safety requirements

The Health and Safety at Work Act 2015

2.23. The Health and Safety at Work Act 2015 was the underpinning legislation for workplace health and safety in New Zealand and applied to New Zealand-registered vessels wherever they were operating. The Act imposed a duty on each person conducting a business or undertaking (PCBU) to ensure, as far as was reasonably practicable, the health and safety of workers who worked for the PCBU and workers whose work

activities were influenced or directed by the PCBU. In respect of the *San Granit*, Sanford as a maritime operator was the PCBU.

2.24. The Act also imposed a duty upon all workers to:

- take reasonable care for their own health and safety
- comply with any reasonable instruction that is given by the PCBU as far as they are reasonably able
- co-operate with any reasonable policy or procedure that the PCBU has notified to them.

The Health and Safety at Work (General Risk and Workplace Management) Regulations

2.25. The Health and Safety at Work (General Risk and Workplace Management) Regulations 2016 required a PCBU to identify hazards and protect against those hazards using a hierarchy of control measures (see Figure 8), to maintain and review the control measures, and to provide information, supervision, training and instruction to workers.

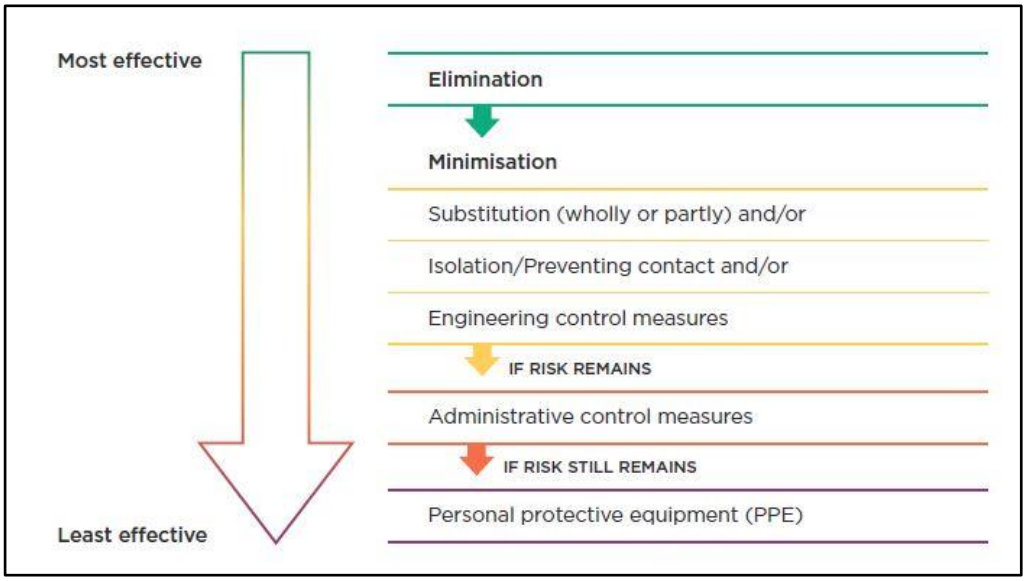

Figure 8: Recommended hierarchy of safety controls (credit: WorkSafe New Zealand)

Maritime Rules

2.26. Maritime Rules Part 31: Crewing and Watchkeeping required owners and masters to establish and implement procedures to ensure that each seafarer was fit for duty. Additionally, each crew member was required to ensure their own fitness for duty and take into account the nature of their duties and the impacts of impairment factors on their ability to undertake those duties.

2.27. Maritime Rules Part 19: Maritime Transport Operator – Certification and Responsibilities required maritime transport operators "to develop, and operate in accordance with, safety systems that are specific and appropriate to their maritime transport operation". Harm-prevention measures and safe operating procedures that address all reasonably foreseeable hazards are fundamental to any such safety system. Where applicable, the system must include procedures for the safe operation of all machinery and equipment and policies to reduce the hazards presented by drug and alcohol use and fatigue.

2.28. Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships contained the requirements for fish processing equipment on board New Zealand fishing vessels. Part 40D.82(h) stated that "moving parts of machinery and other installations, as well as gears that may present a hazard, must be adequately guarded".

Industry guidelines

2.29. In October 2017 Maritime New Zealand published guidelines on machinery hazards, risks, safe operation and maintenance in the Safe Use of Machines on Ships. It provided general advice on how a maritime operator could meet its obligations under the Health and Safety at Work Act:

- identify machinery hazards in their operation
- assess the risks posed by machine hazards (i.e. how severe the harm could be and how likely an accident is to occur)
- manage those risks by applying the best practicable control measures to eliminate the risks, or (if this is not practicable) minimise the risks
- give workers information about machines and their hazards
- train workers to safely use and maintain machinery
- supervise workers when they are using and maintaining machines.

2.30. The guidelines also presented the concept of the 'safe machine triangle', through which marine operators could make machinery safer by: eliminating or minimising identified hazards; developing appropriate safe operating procedures when risks could not be minimised in other ways; and practising good machine maintenance.

2.31. Maritime New Zealand had also published guidance[3] on shipborne machine guarding.

Impairment

2.32. A New Zealand-registered fishing vessel more than 24 metres in length, which proceeded beyond the inshore limits, was subject to the requirements of Maritime Rules Part 31.29: Fitness for Duty. This part explained the responsibilities placed on operators and masters to establish and implement procedures to ensure seafarers were fit for duty. The procedures had to take into account work cycles, the nature of work, reasonably foreseeable perils that may arise during a voyage and the nature and causes of impairments such as fatigue, stress, and alcohol or drug consumption. Notwithstanding the operators' procedures, it was the responsibility of every seafarer to remain fit for duty and free of impairment from alcohol or drug consumption.

2.33. Impairment factors share common signs and symptoms, such as:

- moodiness
- forgetfulness
- inability to concentrate
- poor decision-making
- slower reaction times
- reduced hand-eye co-ordination

[3] https://www.maritimenz.govt.nz/commercial/safety/health-and-safety/machine-guarding.asp.

- drowsiness
- dizziness
- impaired visual perception.

2.34. Sanford had a Fatigue Management Procedure that instructed masters to consider a crew member to be fatigued and at risk of falling asleep or having a high risk of being injured if two or more of the following risk factors existed:

- has been awake for more than 16 hours
- is short of sleep
- has had poor quality of sleep
- is working alone in the early hours of the morning
- reports being fatigued.

2.35. The company also had a drug and alcohol policy, which "strictly prohibits the making, sale, purchase, transfer, distribution, consumption, or possession of illicit drugs on Company property". Additionally there were drug and alcohol management procedures, which included the following provisions for drug and alcohol testing of the crew:

- pre-engagement testing
- post-incident testing
- testing with reasonable cause
- 25% of the crew randomly tested prior to the vessel departing on a fishing trip
- 25% of the crew randomly tested when the vessel arrives back in port
- testing after indication from a detector dog at the port gate and on board
- testing during rehabilitation measures that are offered to crew members who admit drug and/or alcohol use and seek help prior to being caught by the testing regime.

2.36. The post-mortem carried out on the freezerman included a toxicology test, which found that there was a quantity of methamphetamine present in their blood.

3. Analysis

Introduction

3.1. Since taking delivery of the *San Granit* the operator had carried out a series of safety assessments to try to identify any safety measures or guarding solutions required to reduce the risks associated with factory operations. Difficulties in fitting interlocked guarding meant that safety measures focused largely on administrative controls, which relied on operators following procedures and instructions.

3.2. The freezerman was working alone in the early hours of the morning. There were no witnesses to the accident and there was no closed-circuit-television monitoring in the area. Therefore the reason for the freezerman entering the guarded area could not be determined, but it may have been to clear a jammed box of fish.

3.3. The following analysis considers the actions and preconditions that likely led to this accident occurring and the safety measures in place at the time of the accident. It also discusses the following two safety issues:

- the risks associated with operating the accumulator were not fully understood and the safety controls relied heavily on the machine operator following generic instructions and procedures
- the training in place for the crew around the configuration of the emergency stops likely resulted in confusion on which emergency stops serviced which system.

What happened

3.4. The freezerman had been trained and signed off to work in the freezer area; this included being permitted to enter the guarded area when required.

3.5. The freezerman was found trapped in a position that showed it was very likely they were reaching into the accumulator when the accident occurred. It is about as likely as not that the freezerman reached into the accumulator attempting to clear a box of frozen product that had become misaligned.

3.6. The accumulator was found to have been operating in automatic mode at the time of the accident. In this mode, when the hydraulic ram that raised and lowered the floor of the accumulator was activated, the attached framework (see Figure 9) would lower. It was therefore likely that the hydraulic ram was activated by the freezerman triggering a sensor. This then lowered the attached framework and trapped the freezerman between the static and moveable sections of the framework.

3.7. It is not known which route the freezerman took when approaching the accumulator. The safest route was from the weighing and packing station (see Figure 10), entering through the gate after switching off the power to the accumulator located on the touch screen at the weighing and packing station. However, depending on the freezerman's location at the time of the box jam, there were faster but less safe alternative routes to enter the guarded area. These routes would not have taken the freezerman past the controls that isolated the machinery.

3.8. The investigation was unable to determine why the freezerman did not follow the basic safety rules before reaching into the accumulator, but it is about as likely as not that the

freezerman's decision-making abilities were adversely affected by some form of impairment.

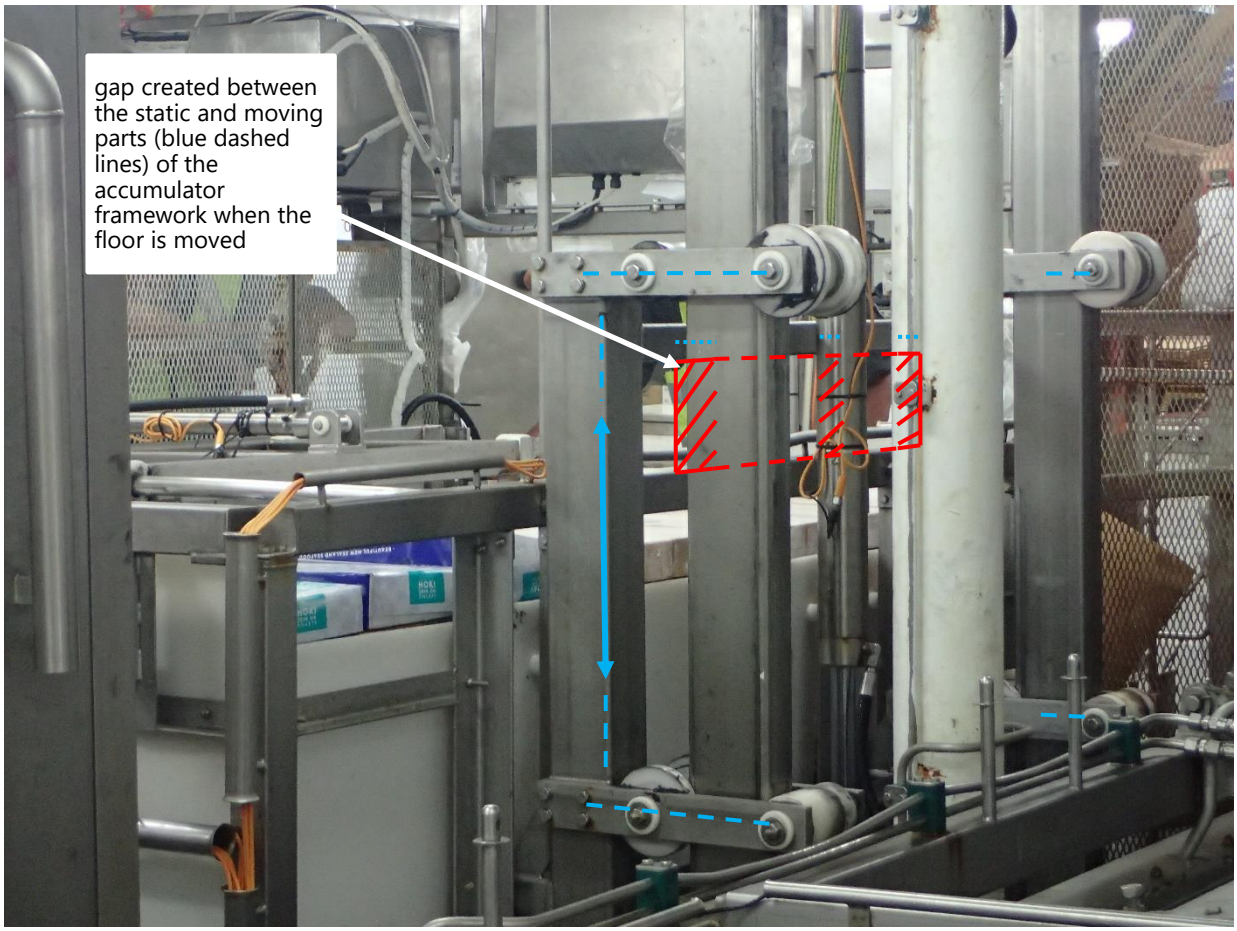

Figure 9: View of the accumulator showing the area where the freezerman was entrapped

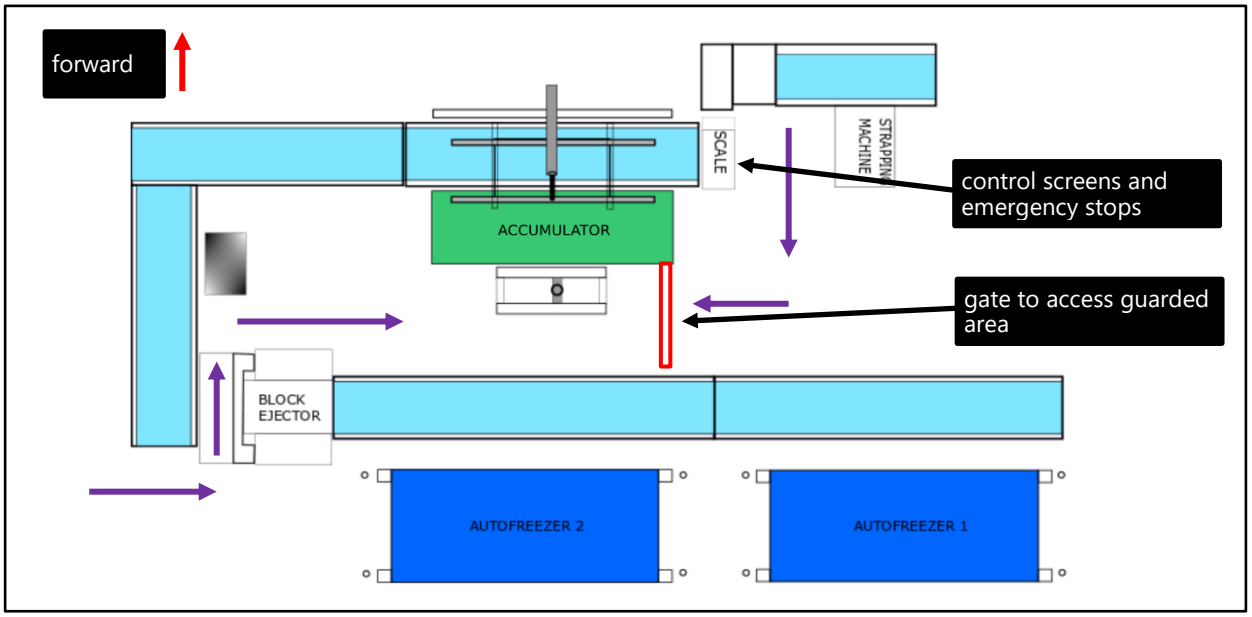

Figure 10: Possible ways to reach the back of the accumulator (indicated by purple arrows)

Factory safety measures

3.9. Prior to the *San Granit* becoming fully operational, three safety assessments had been undertaken to assist the risk assessment process in respect of machinery, guarding and safe operating procedures for the equipment fitted in the factory.

3.10. The accumulator had been identified as posing an injury risk at a nip point between two conveyor belts. It had been decided to include the accumulator within the automatic plate freezer guarded area rather than install a separate guard cover over the top of it. Guarding around the automatic plate freezers, including the accumulator, had been installed at the end of the shakedown trip, but other safety measures for the area had not been finalised. The subsequent report had stated:

> The stacker sliding door guarding system that encompasses the automated freezer operation has been completed, there are a dozen locks fitted to doors to prevent any unauthorised entry, two keys can open the completed set. A SOP [safe operating procedure] is currently being developed, the responsibilities of the keys will be clearly outlined, eg: on who has access. A new risk assessment has been completed there are multiple hazards with in this operation [sic]. In regard to the exposure of entanglement, crush and shearing type injuries with the gates locked the risk has been lowered to a M8 [moderate 8], the installation of an interlock system would reduce the likelihood to low.

3.11. When the *San Granit* had become operational in January 2017, there were several safety operations that could only be reviewed and developed by observing the performance of the crew and the factory machinery at sea. Throughout 2017 the safety measures already taken had been monitored and various issues had been discussed at the on-board EH&S meetings. An examination of the minutes from these meetings showed that there had been ongoing discussions about balancing safety measures with operational practicality and efficiency. A fourth safety assessment, carried out in December 2017, had been aimed at determining the effectiveness of the new guarding and resolving

ongoing issues with its functionality. The safety assessment report had stated that the operator may wish to have interlocks fitted to the automatic plate freezers' guarding system as recommended the previous year. However, there had been operational issues that made fitting interlocks impractical (see 2.13).

3.12. It was in June 2018 that a solution had been found, the automatic plate freezer guarding issues had been removed from the EH&S meetings and the system improvement notice had been closed. The solution had been to move the automatic plate freezer controls outside the guarded area, thereby eliminating the need for a person to enter the area to operate the controls. This in effect had reduced the likelihood of an incident occurring. However, if an authorised person had decided to enter the area without making the machinery safe before entering, the same hazards would have been still present.

3.13. At the time of the accident, the gate between the weighing and packing station and the back of the accumulator was not fitted with an interlock. Therefore it was possible for the freezerman to pass through the gate and enter the ring-fenced area without the machinery shutting down automatically.

3.14. The hazards posed by the vertical movement of the accumulator floor and associated framework had not been identified and assessed. Several crew members who were interviewed recognised that the accumulator had always to be switched off by using the emergency stop and switching to manual mode before attempting to clear a jammed box.

3.15. It had been noted in EH&S meetings that there was confusion surrounding the emergency stops in the factory, particularly on which emergency stops serviced which system, due to their not being properly labelled. The investigation found that only the emergency stop on the operator's touch screen and the emergency stop button on the side of the touch screen (see Figure 6) cut the power to the accumulator.

3.16. Post-accident recovery actions required the operation of the accumulator, and as a result the status of the emergency stops at the time of the accident could not be determined. Attempts to recreate the accident scenario showed it was very likely that the freezerman did not operate the accumulator emergency stop. This recreation, together with interviews conducted in the course of the investigation, identified some confusion among crew on which emergency stop serviced which system. The investigation found, through interviews with the crew and the recreation of the accident, that the confusion identified in the EH&S meetings was likely the result of poor awareness of the emergency stop configuration that had been passed on through training. While it was unlikely that this issue contributed to the accident, crew could potentially access running machinery after pressing an incorrect emergency stop.

3.17. From the time that the *San Granit* had become operational to the time of the accident, the hazards presented by the automatic plate freezer system had been a focus of attention. The risks associated with the accumulator had been overlooked, and as a result there had been no machine-specific instructions for its safe use.

3.18. Had a separate risk assessment and task analysis been carried out specifically for the accumulator, it may have provided the operator with a more thorough understanding of the risks and hazards likely to be encountered. It would also have provided an opportunity to identify practicable engineering controls to reduce the risks (see Figure 8). Once inside the guarded area, the only safety controls available to the operator of the

accumulator were basic training in machine safety and an area-specific safe operating procedure.

3.19. On this occasion, had the freezerman followed the procedure for clearing a blockage in the automatic plate freezer area (see Appendix 1) that incorporated the accumulator, it is very likely that the accident would not have occurred.

3.20. Similarly, had the advice from the earlier safety assessments been heeded and interlocks fitted at access points to the guarded area, the risk could have been minimised and not been reliant on administrative controls alone. All the machinery would have been shut down when the freezerman entered the guarded area and the accident would not have occurred.

3.21. Since the accident the operator has taken action to address the safety issues associated with the automatic plate freezer and accumulator area (see section 5.6). As a result, the Commission does not intend to make a recommendation.

Fitness for duty

3.22. The Health and Safety at Work Act includes a person's behaviour as a hazard "where that behaviour has the potential to cause death, injury, or illness to a person (whether or not that behaviour results from physical or mental fatigue, drugs, alcohol, traumatic shock or another temporary condition that affects a person's behaviour)"[4].

3.23. The use of performance-impairing substances by an individual operating complex machinery is a risk to that individual and anyone reliant on the correct functioning of that machinery.

3.24. There are several factors that can lead to impairment. In the case of this accident, the positive result of the freezerman's toxicology test for the presence of methamphetamine was a source of potential impairment. The Commission sought an expert's opinion on the possible role of methamphetamine consumption and its contribution to the accident[5]. Parts of the resulting report are summarised in paragraphs 3.25 to 3.27.

3.25. Methamphetamine can be eliminated from the body within one to three days, which is a relatively short space of time. It is exceptionally unlikely that the methamphetamine was consumed before the commencement of the voyage two weeks before the accident.

3.26. Methamphetamine consumption has a non-linear and inconsistent effect on the body in relation to intoxication and impairment. A dose that may enhance performance in one person can be an overdose for another person. The effects in general are complex and wide ranging; many remain open to legitimate scientific inquiry and debate. Many of the effects seen in a person who has consumed methamphetamine will also be seen in a person who is undergoing severe psychological stress and anxiety. Research into methamphetamine use amongst drivers has shown that in some cases the drug can be a performance enhancer, but there remains an increase in risky behaviour such as speeding and departure from the lane of travel[6].

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[4] Health and Safety at Work Act 2015, section 16.

[5] Professor Johan DuFlou, Consulting Forensic Pathologist, Forensic Medical Associates, New South Wales.

[6] Logan B, Fligner C, Haddix, T. Cause and manner of death in fatalities involving methamphetamine. Journal of Forensic Sciences 1998;43:28-34. As referenced by Professor Johan DuFlou.

3.27. The blood methamphetamine level indicated that it was virtually certain the drug had been consumed whilst at sea. The psychoactive effects of the drug can last from six to twelve hours, but because it is not known when or how it was administered it is about as likely as not that the psychoactive effects had dissipated, yet it remained readily detectable in blood. The expert was unable to conclude with certainty whether the methamphetamine use contributed to the circumstances leading up to the accident. However, the combined effects of drug use, shift work and possible fatigue on an essentially unsupervised factory operator very likely increased the risk of an accident occurring.

3.28. The operator's drug and alcohol policy testing regime (see paragraph 2.35) was over and above that described by industry guidelines; nevertheless, it was still possible for crew members to elude detection. Substances such as methamphetamine, which are cleared from the body in a matter of days, could be taken by crew members while the vessel was at sea without the risk of detection by random testing.

3.29. As part of the operator's safety induction training, crew were required to watch a video about the dangers of alcohol and drug use in the workplace. The video was informative and confronting. However, this accident shows that education and a testing regime are still not deterring some crew members from taking illicit drugs at sea.

3.30. Maritime New Zealand has taken a joint approach with fishing industry leaders to increase awareness of the adverse effects of stress, fatigue and drug and alcohol use at sea. Recent and continuing educational campaigns have focused on these issues and provided operators with guidance on which to base their policies and training programmes[7]. Appendix 3 has a copy of a collaborative information brochure called 'Dealing with drugs'. A survey on the subject of drug and alcohol use has shown that the self-reported use of alcohol and other drugs in the fishing industry is consistent with use in the general population of New Zealand. These figures are also consistent with non-negative test results in the New Zealand fishing industry.

3.31. The consumption of alcohol and the use of other performance-impairing substances have been a recurring contributory factor in injuries and deaths in all transport modes and have been on the Commission's Watchlist for a number of years. Although the risk of this type of accident recurring is considered to be low, the ongoing work being carried out by Maritime New Zealand and the industry on drug awareness issues within the fishing industry supports the health and safety legislation, which aims to keep risk as low as reasonably practicable.

Fatigue and stress

3.32. The operator recognised that shift work is known to contribute to fatigue and that in turn fatigue and stress are risks to the health and safety of sea-going crews. The Introduction to Safety On-board handbook encouraged crew to take as much rest as possible, eat well and try to stay warm and dry. It stated, "Fatigue affects your strength, your coordination and your judgement and makes you more likely to have an accident." The handbook encouraged crew members to try to get as much sleep as possible during their off-duty hours and to take breaks and stay well hydrated to minimise the effects of fatigue.

[7] Maritime New Zealand Safety Bulletin, issue number 30, November 2014.

3.33. Sanford also had a Fatigue Management Procedure, which placed the responsibility on the master to identify fatigue in members of the crew. The information provided in the Fatigue Management Procedure followed the advice outlined in Maritime New Zealand's guidance (see Appendix 2) on how to develop a fatigue management plan and how to detect the effects of fatigue on a seafarer. Although tiredness was an accepted risk associated with working in the factory, the factory manager was known to ask the crew on each shift if there were any fatigue or tiredness issues.

3.34. The factory crew worked in shifts of six hours on and six hours off. The shift pattern was chosen by the operator to enable the factory to operate 24 hours a day while minimising the effects of fatigue. Although the activities of the freezerman during off-duty hours are unknown, the consumption of illicit drugs in a shipboard environment with a shift pattern in place raises the risk of a fatigue-related accident. The use of a stimulant drug such as methamphetamine may have provided a short-term reprieve from tiredness, but as the stimulant effects wore off, tiredness and fatigue would have been exacerbated.

4. Findings

4.1. The freezerman became trapped in the hydraulic-driven accumulator and received fatal injuries.

4.2. The measures taken by the operator to mitigate the risk of employees being harmed by the accumulator relied on staff following the prescribed procedure for the freezer machinery before entering the restricted area.

4.3. The accumulator did not have its own risk assessment or safe operating procedure, and therefore the risk of an operator becoming trapped in the framework while it was operational had not been identified.

4.4. It is not known why the freezerman did not follow the safety rules before reaching into the accumulator, but it is about as likely as not that the freezerman's decision-making abilities were adversely affected by some form of impairment.

4.5. It was not possible to establish whether the freezerman was suffering from fatigue at the time of the accident. However, the risk of a fatigue-related accident was raised by the shift pattern, lone working in the early hours of the morning at a time when human performance can be adversely affected, and sleep disruption due to the effects of consuming methamphetamine.

4.6. The operator's drug and alcohol policy did not deter some crew members from using illicit drugs while at sea.

4.7. The blood methamphetamine level indicated that it was virtually certain the drug had been consumed whilst at sea. However, it could not be determined whether it contributed to the accident.

5. Safety issues and remedial actions

General

5.1. Safety Issues are an output from the Commission's analysis. They typically describe a system problem that has the potential to adversely affect future operations on a wide scale.

5.2. Safety Issues may be addressed by safety actions taken by a participant, otherwise the Commission may issue a recommendation to address the issue.

Risks associated with operating the accumulator

5.3. The risks associated with operating the accumulator were not fully understood and the safety controls relied heavily on the machine operator following generic instructions and procedures.

5.4. To address this safety issue, Sanford engaged an industrial maintenance and guarding expert to carry out a full safety assessment of the automatic plate freezer area on board the *San Granit*. The resulting project involved:

- replacing the automatic plate freezer guards with permanent guarding
- reconfiguring the factory emergency stop system
- fitting interlocks and anti-tamper devices to gates to the guarded area
- installing a light curtain above the scales to prevent access to the guarded area over the scales
- fitting a safety valve to the hydraulic system to release any residual pressure in the system when an emergency stop or an interlock is activated
- revising the risk assessment and safe operating procedures for the automatic plate freezer area.

5.5. In the Commission's view this safety action has addressed the safety issue. Therefore, the Commission has not made a recommendation.

Crew training

5.6. The training in place for the crew around the configuration of the emergency stops likely resulted in confusion on which emergency stops serviced which system.

5.7. At the time of approving this report for publication, no action had been reported to the Commission to address this safety issue. Therefore, the Commission made a recommendation in section 6 to address the issue.

6. Recommendations

General

6.1. The Commission issues recommendations to address safety issues found in its investigations. Recommendations may be addressed to organisations or people, and can relate to safety issues found within an organisation or within the wider transport system that have the potential to contribute to future transport accidents and incidents.

6.2. In the interests of transport safety, it is important that recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

6.3. In this case, a recommendation has been issued to the Chief Executive of Sanford Limited.

New recommendation

6.4. On 25 March 2020 the Commission recommended that the Chief Executive of Sanford Limited implement training for the crew on the configuration of the emergency stops to avoid confusion on which emergency stop services which system. This will reduce the likelihood of crew accessing running machinery after pressing incorrect emergency stops. (002/20)

On 21 May 2020 Sanford Limited replied:

> Sanford wishes to co-operate fully with the Commission and is actively taking steps to implement the recommendation for further training on Estops.

On 09 June 2020 Sanford Limited further replied:

> Sanford has actively taken steps to ensure awareness and understanding of emergency stops and to implement the Commission's recommendation … the following action has been taken post the accident:
>
> - The crew on the San Granit is refreshed on the induction process (which includes the emergency stops) annually;
> - The crew on both swings was refreshed on factory SOPs (including emergency stops relevant to each crew member's tasks) after the incident and before the vessel returned to sea. We understand crew frequently test the emergency stops before the start of each shift;
> - Numerous Factors [sic] SOPs were reviewed and amended. All crew have been refreshed on the new SOPs. Of note the SOPs around the auto plate freezer have been updated and crew retrained.
> - Further crew retraining is expected to be completed in the near future as soon as practicable having regard to the fact that the vessel has 2 swings and is at sea for extended periods of time (up to 6-7 weeks).

7. Key lessons

Previous key lesson

7.1. The Commission repeats one key lesson made in a previous report:

- it is not acceptable under any circumstances for workers to be affected by performance-impairing substances, regardless of what roles they are performing.

New key lesson

7.2. The Commission identified one new key lesson:

- carrying out a task analysis on any piece of machinery is an important safety function that helps to identify and understand foreseeable hazards associated with its use and identify best practicable control measures that can be introduced to reduce the risk to operators. When it is not possible to eliminate an identified hazard, a task analysis will help to ensure robust operating procedures are in place, which in turn will assist in the development of future user training requirements.

8. Data summary

Vehicle particulars

Name:	*San Granit*
Type:	factory fishing stern trawler
Class:	DNV ✠ 1A1, stern trawler, ICE-1C, EO
Limits:	unlimited
Classification:	Det Norske Veritas – Germanischer Lloyd (DNV-GL)
Length:	67.40 metres
Breadth:	14.50 metres
Gross tonnage:	2,487
Built:	keel laid 28 March 1989
Propulsion:	one four-stroke diesel, total output 3,375 kilowatts
Service speed:	13 knots
Owner/operator:	Sanford Limited
Port of registry:	Timaru
Minimum crew:	11

Date and time	14 November 2018, 0350
Location	55 nautical miles east of Banks Peninsula
Persons involved	freezerman
Injuries	fatal injuries
Damage	nil

9. Conduct of the inquiry

9.1. Maritime New Zealand notified the Transport Accident Investigation Commission (Commission) of the accident on 14 November 2018. The Commission opened an inquiry the same day under section 13(1)b of the Transport Accident Investigation Commission Act 1990, and appointed an investigator in charge.

9.2. The same day, two investigators travelled to Timaru and boarded the *San Granit* to conduct interviews and collect evidence.

9.3. On 15 November the investigators interviewed the factory manager, the deckhand who found the deceased, a factory supervisor and the second officer/medic. The machinery involved in the accident was observed in its operational mode to gain a better understanding of the events that led to the accident.

9.4. On 31 January 2019 two investigators returned to Timaru to interview the master, a freezerman[8] from the opposite shift, and the company safety administrator involved with risk assessments and the creation of safe operating procedures.

9.5. On 10 July 2019 two investigators met with the freezerman's next of kin.

9.6. On 25 September 2019 the Commission approved a draft report for sending to interested persons for comment.

9.7. The draft report was circulated to seven interested persons. Four responses, including three submissions, were received.

9.8. The Commission considered these submissions in detail and any changes as a result have been included in the final report.

9.9. The Commission approved the report for publication on 2 April 2020.

[8] A factory worker responsible for freezing, packing, weighing and labelling fish products.

10. Report information

Abbreviations

EH&S	environmental, health and safety
PCBU	person conducting a business or undertaking

Glossary

factory trawler	a fishing vessel fitted with factory equipment for processing, packaging and freezing fish products
freezerman	a factory worker responsible for freezing, packing, weighing and labelling fish products
shakedown	a preliminary trip during which adjustments can be made to improve a vessel's functionality and efficiency and bring it to a satisfactory state for entering its operational phase

11. Notes about Commission reports

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant
Commissioner	Paula Rose, QSO

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Aaron Holman
Investigator in Charge	Captain Jennifer Cuttriss
General Counsel	Cathryn Bridge

Citations and referencing

This draft report does not cite information derived from interviews during the Commission's inquiry into the occurrence. Documents normally accessible to industry participants only and not discoverable under the Official Information Act 1982 are referenced as footnotes only. Publicly available documents referred to during the Commission's inquiry are cited.

Photographs, diagrams, pictures

The Commission has provided, and owns, the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

This report uses standard terminology to describe the degree of probability (or likelihood) that an event happened, or a condition existed in support of a hypothesis. The expressions are defined in the table below.

Terminology*	Likelihood	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

*Adopted from the Intergovernmental Panel on Climate Change

Appendix 1: Risk assessment and safe operating procedure for the freezer breakout area

Hazard Register: Mango: **DWD Vessel San Granit Factory**

1.0 Risk Assessment

Aspect	Area	Who Could Be Harmed	How Could they be harmed	Initial Risk	Control	Residual Risk
Environment	Automated freezers	Crew	Noise from operations in the factory humid heat causing dehydration, cold, wet, Icey environment, vessel movement, poor lighting causing slip, trip, falls, fatigue.	H12	• Refer to s.o. p	M6
Equipment	Fillet tray press	Baader tech Factory manager Foreman contractors	Crush, entrapment from fish trays/hydraulic rams, hydraulic Leaks, slip, trip fall, nips, Accidental start up when clearing blockages and maintenance greasing rams.	H12	• Isolation (ring fencing around freezer • Break out area.) • Refer to s.o.p	M8
	Fillet tray feed conveyor to freezers	Crew Contractors	Fingers hands being crushed from fish trays, nips, share from conveyor, hydraulic Leaks Accidental start up when clearing blockages and maintenance. Slip trip falls during maintenance.	H12	• Isolation (ring fencing around freezer • Break out area • Refer to s.o.p	M8
	Fillet tray delivery ram system to freezers	Baader tech/engineers Factory managers Factory Foreman Contractors	Fingers, hands, arms could get crushed from up and down movements of the delivery system, accidental start up when clearing tray blockages, jam ups and while doing maintenance.	H12	Isolation (ring fencing around freezer, Break out area Emergency stops Refer to s.o. p	M8
Equipment	Freezers	Baader tech/engineers freezer man	Entanglements from screw drive, crush from freezer plates, freezer burn from frozen	H12	Isolation (ring fencing around freezer Break out area Emergency stops	M8

Aspect	Area	Who Could Be Harmed	How Could they be harmed	Initial Risk	Control	Residual Risk
		Contractors	surfaces, slip, trip, falls when conducting maintenance, accidental start up.		Refer to s.o. p	
	Break out conveyor area	Baader tech/engineers freezer man Contractors	Crush, from tray blockages, slip, trip, falls Icey surface, nips, share from fabric conveyor Rotating shafts pulling in loose clothing	H12	Isolation (ring fencing around freezer Break out area.) Refer to s.o. p	M6
	Block ejector	Baader tech/engineers freezer man Contractors	Fingers, hands being crushed, amputated from ejector rams or fish trays when clearing blockages.	C16	Isolation (ring fencing around freezer Break out area Refer to s.o. p	H12
	Feed belt to freezer weigh station	Baader tech/engineers freezer man Contractors	Drive roller/ sprocket nip points, paddle and moving entrapment points, jammed belts, belt transfer nip points	H12	Isolation (ring fencing around freezer Break out area. Refer to s.o. p	M6
Materials	Refrigerant (Ammonia)	Factory crew Baader techs Engineers Contractors	Incorrect operation of freezer system, break out system lack of maintenance could cause damage to fittings resulting in an ammonia leak	C15	Ammonia mask available Maintenance checks, Refer to sop Emergency drills	H10
	Hydraulic oil	Factory crew Baader techs Engineers Contractors	Incorrect operation of freezer system, break out system lack of maintenance could cause damage to fittings resulting in an oil leak, slip, trip, fall.	H12	Safe operating procedure Training, instruction, supervision Personal protective equipment Emergency procedures Ammonia mask available Maintenance checks	M6
Materials						

Aspect	Area	Who Could Be Harmed	How Could they be harmed	Initial Risk	Control	Residual Risk
People	Competency	crew	Unskilled/ young person not being aware of dangers. Human violation	H12	safe operating procedure Personal protective equipment discipline.	M8

2.0 Safe Work Method

Step	Description	Hazards	Safety Requirements	Responsibility
1	Set up automated freezer system	Moving hydraulic rams. Moving belts. Fillet trays Cold surfaces Ammonia Hydraulic oil	• Check freezer automated area is clear and free of obstructions • Turn on freezers • Close all the safety fences and lock • Remove LOTO • When all clear is given activate automated system	Factory manager or supervisor
2	Operate	Moving hydraulic rams. Moving belts. Fillet trays Cold surfaces	• Run up the system checking for any abnormal noises or blockages	Factory manager or supervisor
3	Manual operation of system	Moving hydraulic rams. Moving belts.	• Open desired safety gate • Use control panel located on front of freezer load platform • Operate chosen Freezer system	Factory manager or supervisor Freezer man
4	Blockages/ Maintenance	Moving hydraulic rams. Moving belts. Fillet trays Cold surfaces	**Bypass switch Description:** Retrofitted sensors that have been installed to prevent the freezers from destroying themselves and to safe guard personal in the immediate area in the event of a jam-up. These sensors are part of the E-Stop safety circuit. Therefore, it is not possible to move the freezers to clear the Jam-up once these sensors are activated. This is why a key controlled service bypass switch has been installed. This switch is only used by trained personal **(Factory Manager, Baader Tech, Engineer)** under controlled conditions.	

			• Move freezer selector switch from "Auto mode" to "Manual mode" • Contact designated personal to activate bypass switch. • Move freezer to release pressure as required. • Designated personal to deactivate bypass switch and engage E- STOP • E-stop circuit then tested by designated personal. • Blockage to be removed • Resume normal operation	Freezer Man Factory Manager, Baader Tech or Engineer Freezer Man
5	Cleaning		• LOTO • Open safety gates • Use correct P.P.E • Commence Cleaning. • Fresh water only	Factory manager or supervisor

Appendix 2: Understanding Fatigue brochure

UNDERSTANDING FATIGUE

This brochure covers what is fatigue for seafarers and how to manage it, including:

- the importance of sleep
- what causes fatigue
- your legal obligations
- strategies for getting enough sleep.

WHAT IS FATIGUE?

Mostly it is lack of sleep

Most accidents caused by fatigue follow a lack of sleep or poor-quality sleep. Poor-quality sleep is when your sleep is disturbed, eg by light, noise, motion, alcohol or drugs.

Fatigue accumulates when you do not get extra sleep to make up for lost sleep. The answer to fatigue that builds up over a few nights (cumulative fatigue) is easy – sleep. There is no other answer.

Other conditions, like heat or long physical work, can make fatigue caused by lack of sleep worse. But accidents are usually linked with lack of sleep.

WE NEED TO SLEEP

Understanding how the body's need to sleep works is the starting point for managing fatigue. The need to sleep is built into our bodies in two ways:

- the need for recovery after being awake for a while
- our body clock.

People are designed to spend about a third of their lives sleeping. Scientists don't really know much about why we need to sleep so much, but they do know that if we don't sleep our performance and health can suffer.

The need for recovery

After being awake for a while, our bodies and brains do not function as well. Sleep is needed to recover from all the things we do when we are awake.

Most people sleep about 8 hours a day when they have the opportunity to do so. So, after being awake about 16 hours we are naturally ready to go to sleep. While we can continue to stay awake, the chances of something going wrong increase, as time passes.

Our body clock

Our body clock naturally programmes us to be asleep at night. There is also a natural tendency to not be so alert in the middle of the afternoon. At other times we are programmed to be alert.

Times of high alertness

- Mid-morning to early-afternoon
- Around 6.00 pm – 9.00 pm

Sleep is almost impossible at these times. Your body clock gives you an alertness kick. You will feel more alert and capable. But if you have been working long hours, in reality your performance will not be up to scratch.

Times of high sleep need

- Around 3.00 am – 5.00 am (highest need)
- Around 3.00 pm – 5.00 pm (siesta time)

It is easy to make mistakes and fall asleep at these times.

Regular night shift workers may find these times vary a little.

CAUSES OF FATIGUE

Environment

The maritime work environment is stressful on seafarers and can make fatigue from lack of sleep worse. Common environmental stressors on seafarers are:

- cold
- heat
- ship's motion
- vibration
- noise
- diet – what, when, how much.

Job design

Common features of job design that lead to fatigue are:

- A long work day – made worse by working extra hours.
- Physical work – especially long spells of hard work.
- Boring or repetitive work, eg watchkeeping at night.
- Few or no breaks.
- A pay system that encourages long hours.
- Not allowing enough time for sleep.
- Unpredictable work schedules. Predictable work makes it easier to fit your life to work demands.
- Sleep opportunities during natural times of high alertness.
- Mentally demanding tasks, eg controlling a fishing vessel when looking for and catching fish.

Lifestyle and home

Seafarers have to balance work, lifestyle/home and sleep. Often lifestyle and home demands come ahead of sleep, making them a cause of seafarer fatigue. Common lifestyle and home demands are:

- commuting
- time with family
- time with friends
- family routine disrupting sleep
- jobs around the house
- another job
- time to do your own thing
- alcohol (which makes the second half of sleep of poor quality)
- stress
- medication.

Ongoing effects of inadequate sleep include increased risk of obesity diabetes, and heart disease, as well as increased risk of accidents (at work and while driving).

MANAGING YOUR FATIGUE

Legal obligations

Under the Health and Safety in Employment Act 1992, fatigue is a hazard that must be managed. Crew (both those on wages and those who are self-employed) must take all practicable steps to ensure that nothing they do at work harms themselves or any other person. You are responsible for taking sensible safety precautions – like letting your employer know if you are having sleep problems and ensuring that you get enough sleep during rest periods.

Employers and skippers must take all practicable steps to make sure the boat is safe. Employers must involve employees in the management of hazards. This is a good opportunity for you to raise any concerns you have about fatigue as a hazard.

Planning your time and sleep

Seafaring can be demanding, leaving little time for other activities. Family and friends need time, seafarers often commute and there is still a need to sleep. Sleep time is often traded off for time with family and friends. Often this happens because others do not understand your need for sleep when you are working shifts or long hours. To get the best sleep deal, you should plan with others how they can help you protect your sleep period.

Activities that are hard to change

- working – if doing extra work, discuss the effects with your employer
- commuting

Activities that are often traded for sleep

- eating, showering, etc
- spending time with the family
- doing jobs around the house
- spending time with friends, socialising
- other jobs
- doing your own thing

Work with family and friends to plan how they can help you get the sleep you need. They can only do this if you share your problem with them.

Continued

TAKE THIS BROCHURE HOME

If you work shifts you will be sleeping different hours from others at home. Sharing this brochure with them will help them understand your sleep needs.

FURTHER INFORMATION

Think you might have a sleep problem? See your doctor who can refer you to a sleep clinic.

The Maritime New Zealand website: www.maritimenz.govt.nz has a wide range of information on fatigue, including tests to help assess if you have a sleep problem, are a morning or evening type, a list of sleep clinics and links to further information about fatigue.

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www.maritimenz.govt.nz
2007

newzealand.govt.nz

MARITIME NEW ZEALAND

How much sleep?

Most people need 7-8 hours sleep per night to be fully rested. Maritime New Zealand recommends a minimum of 6 hours continuous sleep per 24 hours. Even with 6 hours sleep, fatigue will accumulate. As a general rule try to get:

- in a 7-day period, a minimum of 77 hours off duty and
- 2 consecutive nights of sleep at least once every 2 weeks, better if once per week. (Sleep between 10.00 pm and 8.00 am, so you get the best quality sleep.)

Splitting sleep into two or more sessions over the day will leave you less restored physically and mentally than when sleep is in one period.

If you work an extra long day, try to get extra time off to recover. Your risk is particularly increased if you are already short of sleep.

Napping

Napping helps manage fatigue when you are short of sleep. Best napping times are mid-afternoon and after 9.00 pm.

About every 90 minutes during sleep, you cycle through lighter sleep, deeper sleep and dreaming. Waking from deep sleep leaves you groggy (sleep inertia). To minimise sleep inertia allow yourself either 30-40 minutes for a nap, or about 2 hours, or about 3.5 hours. A cell phone or alarm clock can be used to time the nap.

Sleep environment

The sleeping environment (at work and at home) has a large effect on the quality of your sleep. Poor-quality sleep does not restore you as well, so putting effort into the sleeping environment is worthwhile.

- Block out as much light as possible.
- If noise cannot be blocked, sometimes a "white noise" helps, especially when the noise keeps changing. A radio off-station or a fan as background noise can help.
- Use a sleep mask and ear plugs if necessary.
- If your bed is uncomfortable, ask for something better.
- Keep the temperature of your sleep area cool rather than hot.
- At home turn off alarms, phones and doorbells if trying to sleep during the day.

A sleep routine

Trouble sleeping? A sleep routine helps. Stick at a new routine for a few weeks, to give it a chance of working.

- Pre-sleep routine – have a set pattern of activities leading up to sleep time, so your body learns to wind down and relax. (Shift workers may need a routine for each shift.)
- Go to bed at the same time each day.
- The bedroom needs to be a safe, comfortable place that encourages sleep. Watch television, play video games and write somewhere else.
- Avoid large meals shortly before going to bed. If hungry, have a light snack.
- Avoid alcohol as a sleep aid – overall your sleep will be worse as alcohol disturbs the second half of a sleep.
- Avoid caffeine at least 4 hours before going to bed.
- Avoid heavy exercise before going to bed.

Shiftwork

Daylight and daily activities cue people so their body clock doesn't adjust well to shiftwork. For those working nights this usually means 2-3 hours less sleep per 24 hours. The following hints may help you cope with shiftwork:

- When finishing night work, try to get to sleep as soon as possible. If driving in early morning sunlight, wear dark glasses.
- Nap where possible (discuss with your employer if napping seems like a good strategy for you).
- During the night shift, light food is better than heavy food.
- During the middle of the night, where possible, avoid dangerous and complex tasks.
- Social interaction and light exercise helps maintain alertness if your environment is not stimulating.
- People vary in how they respond to shiftwork; there are morning and evening types, some fall to sleep easily, others don't; with age sleep becomes more disturbed.

MARITIME NEW ZEALAND

Understanding Fatigue

Appendix 3: Dealing with drugs brochure

Don't let your business go up in smoke

Substance abuse is a social problem across the whole country.

People use substances, both legal and illegal, for a number of reasons, including pleasure, belonging, bonding, coping, healing, escaping, or to improve performance.

The challenges of working at sea – repetitive tasks, long hours, missing family and friends – can make crews more vulnerable to substances like methamphetamine and cannabis.

But all substance use carries a risk of harm. On a fishing vessel, it's a safety hazard that can endanger the person impaired by substances as well as those around them.

Turning a blind eye to substance use can leave your boat, your business, your livelihood, and the lives of your crew at risk.

If you drive a car while impaired by alcohol or drugs, you're 23 times more likely to have a fatal accident.*

Working on a fishing vessel is hazardous. Impairment by alcohol or drugs similarly puts you and your co-workers at severe risk.

*NZTA

Help is the best solution

Would you rather someone told you they had a problem with drugs, or discover it by accident – and experience the shock of having been kept in the dark?

The best solution is to talk openly about the dangers of impairment, and encourage your crew to confide in you if they have a problem. If someone needs help, here are some options:

Call the 24-hour **Alcohol Drug Helpline** on **0800 787 797** for confidential advice.

Find a detox programme, drug support group or counselor at **alcoholdrughelp.org.nz/directory/**

Order free handbooks and other helpful brochures on methamphetamine, cannabis and alcohol at **drughelp.org.nz/resources/**

Call the **Alcoholics Anonymous helpline** on **0800 229 6757** or visit aa.org.nz for help with drinking problems.

For tips on safe fishing go to www.maritime.govt.nz/safe-crews-fish-more

Safe crews fish more

Seafood New Zealand

MARITIME NEWZEALAND

Dealing with drugs

How to recognise substance use on board and prevent it from endangering your livelihood and the lives of your crew.

Substance: 'anything capable of inducing a psychoactive effect'.

Safe crews fish more

Seafood New Zealand

MARITIME NEWZEALAND

Signs of substance use on board

Even if you don't think anyone's using drugs on board at the moment, it pays to be aware of the signs.

Removing the top of a lighter can make it easier to cook methamphetamine.

Burnt spoons or bottle tops have almost certainly been used for smoking methamphetamine.

Cotton balls can be used as a filter for drugs cooked in a spoon or cap.

There's no other logical use for a cut up straw than for snorting drugs.

Methamphetamine and cannabis are often packaged in small snap-lock plastic bags.

HSWA

Under the Health and Safety at Work Act 2015, all crew must take reasonable care to ensure that nothing they do on board harms themselves or any other person. Both operators and skippers must make sure the vessel is safe and involve the entire crew in managing any risks. Now is the time for you to raise any safety concerns that you have with your skipper or operator.

Behavioural signs of substance use

Know how to recognise the signs of impairment.

SIGNS OF METHAMPHETAMINE USE

High on meth:

- Excessive talking
- Confusion
- Aggression
- Hyperactivity
- Paranoia
- Extreme mood swings

Coming down from meth:

- Exhausted
- Hungry
- Flat
- Irritable

SIGNS OF CANNABIS USE

- Unusually talkative
- Confusion
- Forgetting things
- Lack of focus
- Moodiness

ALL OF THESE SYMPTOMS CAN LEAD TO SERIOUS, IF NOT FATAL, ACCIDENTS.

SAFETY = MOSS + HSWA

WHO IS RESPONSIBLE

Operator + Skippers + Crew = YOU

The danger of impairment

Someone who can't think clearly or respond rationally can be a danger to both themselves and others, especially around heavy machinery.

Substances like methamphetamine can also increase a person's confidence, making them more likely to take risks. You're already working under hazardous conditions. Can you afford to put your livelihood – and the lives of your crew – at more risk?

Remember too, when you're at sea you're isolated from emergency services. It's pretty clear that substance use has no place on a vessel.

UNDER HSWA EVERYONE HAS A DUTY TO OPERATE SAFELY. A DRUG AND ALCOHOL POLICY PLAYS AN IMPORTANT ROLE IN DOING THIS.

For tips on safe fishing go to www.maritime.govt.nz/safe-crews-fish-more

Safe crews fish more

TAIC Kōwhaiwhai - Māori scroll designs

TAIC commissioned its kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngati Raukawa, Tuwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to prevent them. A 'waka whai mārama (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe or risk free'.

Corporate: Te Ara Haumaru - The safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represent the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for aviation.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Marine: ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Marine'.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai.

Transport Accident Investigation Commission

Recent Marine Occurrence Reports published by the Transport Accident Investigation Commission

MO-2019-202	Fatal jet boat accident, Hollyford River, Southland, 18 March 2019
MO-2019-201	Jet boat Discovery 2, contact with Skippers Canyon wall, 23 February 2019
MO-2018-202	Accommodation fire on board, fishing trawler *Dong Won 701*, 9 April 2018
MO-2018-203	Grounding of container ship *Leda Maersk*, Otago Lower Harbour, 10 June 2018
MO-2018-204	*Dolphin Seeker*, grounding, 27 October 2018
MO-2017-204	Passenger vessel *Seabourn Encore*, breakaway from wharf and collision with bulk cement carrier at Timaru, 12 February 2017
MO-2017-203	Burst nitrogen cylinder causing fatality, passenger cruise ship *Emerald Princess*, 9 February 2017
MO-2017-205	Multipurpose container vessel *Kokopo Chief*, cargo hold fire, 23 September 2017
MO-2017-202	Passenger vessel *L'Austral*, grounding, Milford Sound, Fiordland, 9 February 2017
MO-2016-206	Capsize and foundering of the charter fishing vessel *Francie*, with the loss of eight lives, Kaipara Harbour bar, 26 November 2016
MO-2016-202	Passenger ship, *Azamara Quest*, contact with Wheki Rock, Tory Channel, 27 January 2016
MO-2017-201	Passenger vessel *L'Austral* contact with rock Snares Islands, 9 January 2017
MO-2016-201	Restricted-limits passenger vessel the *PeeJay* V, Fire and sinking , 18 January 2016
MO-2016-204	Bulk carrier, *Molly Manx*, grounding, Otago Harbour, 19 August 2016
MO-2016-205	Fatal fall from height on bulk carrier, *New Legend Pearl*, 3 November 2016
MO-2015-201	Passenger ferry *Kea*, collision with Victoria Wharf, Devonport, 17 February 2015
Interim Report MO-2017-203	Burst nitrogen cylinder causing fatality on board the passenger cruise ship *Emerald Princess*, 9 February 2017
MO-2012-203	Fire on board *Amaltal Columbia*, 12 September 2012

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