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FACE 96-AK-045

To: **Ted Pettit, NIOSH, Division of Safety Research**

From: **Deborah Choromanski**

Occupational Injury Prevention Program

Subject: Crew member struck-by grease fitting during maintenance of vessel steering quadrant -- Alaska

SUMMARY

On November 8, 1996, a 48-year-old male crew member (the victim) died from injuries after he was struck by a grease fitting propelled through the air while performing maintenance on a vessel steering quadrant. The victim was part of a six-person crew of a fishing vessel performing various duties including routine maintenance and repair of the vessel's equipment. At the time of the incident, the vessel was moored at a local harbor. The victim had been on duty for 2 hours and was completing maintenance on the steering quadrant and related assembly in the vessel's aft (rear) storage compartment (lazarette). As part of the maintenance procedure, the victim was greasing the rudder shaft by pumping grease into the rudder shaft tube (or trunk). Assuming the grease connector (or zirk) had malfunctioned, the victim attempted to remove the grease fitting from the trunk. The grease fitting struck and entered the victim near the center of his chest. The victim was able to climb to the vessel deck where he collapsed. Co-workers radioed for emergency medical services. Due to the condition of the victim and the nature of his injury, he was transported by the responding police officer to the local medical clinic. The victim was pronounced dead at the medical clinic. It is surmised that the victim thought the grease fitting had failed and attempted

to remove it without realizing the pressure exerted from the grease within the rudder shaft tube.

Based on the findings of the investigation, to prevent similar occurrences, employers should:

- ensure training for inspection, maintenance, and repair procedures;
- encourage workers to actively participate in workplace safety.

INTRODUCTION

On November 08, 1996, a 48-year-old male commercial fishing vessel crew member (the victim) was killed after being struck in the chest by a grease fitting. On February 11, 1997, the National Institute for Occupational Safety and Health, Alaska Field Office notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an Injury Prevention Specialist for the Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology ensued on February 12, 1997. The incident was reviewed with United States Coast Guard (USCG) officials. Medical examiner and police reports, as well as USCG reports were obtained.

The fishing operation in this incident was privately owned and operated, employing a six-member crew. The victim had worked for the fishing operation for six years. At the time of this report, it is unknown whether a written safety program or maintenance procedure guide were available

INVESTIGATION

The incident occurred aboard a 94-foot commercial fishing vessel, moored in a remote harbor in the western Aleutians. The vessel was equipped with a hydraulic steering arrangement (Figure 1). The steering quadrant and rudder shaft assembly were housed in a storage area below deck referred to as a lazarette. The hydraulic steering

mechanism consisted of twin rams connected to a rudder arm. The rudder shaft (or post) was encased in a rudder shaft tube (or trunk), approximately 3 1/2 to 4 feet in length. The top of the shaft passed through the thrust bearing within the trunk into the quadrant assembly that was seated above the rudder assembly. Due to the continuous stress on and motion of the rudder mechanism, the steering assembly was regularly inspected and maintained including the application of grease to the rudder shaft. A fitting was located approximately mid-shaft on the trunk that allowed a grease gun to connect to the external portion of the fitting referred to as a zirk. The fitting was approximately 1/2 inch in diameter and contained a ball check valve. The check valve consisted of a spring-loaded ball slightly larger than the opening which would be pushed back as grease was forced through the zirk and would return into position to prevent grease from escaping after filling. The fitting was threaded on one end allowing it to be screwed into place on the trunk. The zirk was shaped to accommodate a standard snap coupler for the attachment of a grease gun.

The victim had been performing maintenance on the steering quadrant and rudder mechanism and had been adding grease to the rudder trunk using a manual grease gun. Normally, grease emerged from the top of the trunk when filled to capacity, having flowed around the thrust bearing and out top grease channel; in this case, the victim reported to fellow crew members that no grease emerged and the fitting was not taking any grease. The victim requested a crew member to try to pump grease through the zirk. After exiting the lazarette, the victim stated to a crew member (the witness) on deck that he would change the fitting, assuming the zirk had malfunctioned. The victim returned to the lazarette, positioned himself in front of the fitting, and began using a wrench to remove the fitting. The fitting was released from the trunk with a great force, impacting and penetrating the victim’s mid-chest area. At this time the witness who was still on deck heard a loud “pop” above the regular on deck noise.

The victim was able to climb from the lazarette to the vessel deck where he collapsed. The witness and a second crew member tended to the victim while a third crew member went to the cabin to call an ambulance on the marine radio. Emergency medical services were dispatched at 10:15 am. A responding law enforcement officer arrived at the scene at 10:19 am as the victim was being moved off the vessel. The officer radioed for the location of the ambulance and decided to transport the victim to the local medical clinic. The victim was placed in the back of the officer's pick-up truck and was met enroute by the emergency medical technician (EMT) crew. The victim stopped breathing and CPR was administered by an EMT while continuing to the clinic in the officer's vehicle. The victim was pronounced dead at 10:57 am by the attending physician's assistant who was in contact with a medical center emergency room physician.

CAUSE OF DEATH

The medical examiner's report listed the cause of death as penetrating impact injury to the chest.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure training for inspection, maintenance, and repair procedures.

Discussion: The victim was struck in the chest and killed by a grease fitting under extreme pressure. Following the incident, investigation by a port engineer determined that the grease channel was blocked by the thrust bearing. The vessel maintenance procedure for the steering assembly was communicated verbally to workers. In this case, the victim discussed the procedure with other crew members including the difficulty of adding grease to the rudder shaft. The erroneous position of the thrust

bearing, having lifted approximately 3/4 inch up against the rudder arm, blocked the flow of excess grease through the grease outlet channel causing pressure to build inside the trunk and behind the grease fitting. A manual grease gun with a total capacity of 20 oz. bulk fill can deliver 10,000 pounds per square inch (psi). The available information suggested that pressure in the rudder trunk could have been that high since the grease gun had been pumped more than 100 times. Although verbal procedures were discussed for the maintenance of the steering assembly, inspection guidelines could help employees understand and recognize potential problems.

Recommendation #2: The employer should encourage workers to actively participate in workplace safety.

Discussion: Employers should encourage all workers to actively participate in workplace safety. In this case, the victim, after attempting to pump grease into the rudder trunk, positioned himself in front of the grease zirk to remove and replace the fitting. The potential pressure produced by a manual grease gun may be 10,000 PSI or greater. While the victim may have attempted to check the function of the ball check valve, the true pressure exerted by the grease behind the fitting caused it to release with extreme force. According to several mechanics interviewed, it is not uncommon for a grease fitting to “pop” when it is being removed if there is pressure behind it. Increased participation in safe work practices will aid in the prevention of occupational injuries.

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