Alaska FACE

Fatality Assessment & Control Evaluation

Operator Crushed When Dockside Crane Tips Over

FACE AK-95-008

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SUMMARY

On May 18, 1995 (9:00 AM) a 49-year-old, male "trouble-shooter" (victim) died after the crane he was operating became unbalanced and tipped over. The crane fell over a dock "bull rail" and fell 31 feet into an adjacent bay. The victim was assisting a dock construction contractor remove boulders from a barge berth. As the victim moved a large boulder above the surface of the water, the crane became unbalanced and fell over the side of the dock.. A diver, who was assisting in the boulder removal operation, removed the victim from the wreckage, but he stopped breathing before they reached the shore. Police rescue workers began CPR and were able to reestablish a pulse. The victim's pulse was again lost during transport, but was reestablished at a nearby hospital.

However, the victim's pulse was unable to be sustained and he was declared dead at 11:04 AM.

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

- ensure that a system for accurately measuring loads to be lifted is used by crane operators prior to an attempted lift.
- ensure that crane operators are adequately trained in the use of load measuring devices, crane loading charts, and boom angle charts.
- ensure that crane operators are aware of the effects of buoyancy on loads and the variable loading characteristics associated with loads in different surrounding media.

INTRODUCTION

On May 18, 1995, a 49-year-old, male "trouble-shooter" died when the crane he was operating at a dock became unbalanced and tipped over the side bull rail, falling 31 feet into the bay. The victim was attempting to remove large granite boulders from a barge berthing area at the dock. The victim stopped breathing and could not be revived. The Alaska Division of Public Health, Section of Epidemiology was notified of this fatality by the Occupational Safety and Health Administration on May 19, 1995. An investigation, involving an Injury Prevention Specialist from the Alaska Department of Health and Social Services, Division of Public Health, Section of Epidemiology, an Environmental Health Specialist from the NIOSH, Alaska Activity, and an OSHA Compliance Officer ensued on May 19, 1995. Interviews of the witnesses were conducted, and photographs of the incident crane and fatality site were obtained.

INVESTIGATION

The victim was a company "trouble-shooter" who had been working since the first of the year. His position was to solve a variety of problems at company worksites. The company indicated that the victim had previous crane operation experience, but no formal training in crane operation could be documented. The company employed 19 non-union workers at the site and 1,000 workers were controlled by the company at various sites. The company had a full-time corporate safety officer based in another state. The site had a generic safety program at the incident site, but it did not cover crane operations or crane safety. On the day of the incident the crane operator was using a 20 ton P&H mobile crane to attempt to remove granite boulders from a barge berthing area at a dock.. A general view of the dock, bay, and wrecked crane is shown in figure l on page 3. The incident occurred on the first attempted pick. A diver was assisting in the boulder removal operation by placing lines from the crane around the submerged rock. Diagram l shows the approximate location of the crane prior to the incident. Another worker was directing the crane operator from a point near the section of bull rail damaged during the incident. The crane operator was unable to see the crane's "pick point."

The boulder was lifted and swung laterally from the front of the dock towards the right side of the dock, as indicated by

the boom angle in Diagram 1. As the boulder broke the water's surface, the crane tipped over and was dragged over the side bull rail into the bay when the boulder settled back on the ocean floor. Figure 2 shows the damage to the bull rail where the crane tipped over. Figure 3 shows the position of the wrecked crane in the bay.

The worker near the bull rail noticed that the crane was beginning to tip and ran out of the way. He yelled a warning to the crane operator as he ran. The crane was dragged over the side of the dock, causing extensive damage to the cab before falling 31 feet into the bay. The diver was narrowly missed by the wreckage. The victim came to the water's surface, but his feet were still entangled in the wreckage. The diver extricated him from the crane and began to swim with him toward the shore. During this time the victim stopped breathing. CPR begun by police rescue workers reestablished a pulse, but his pulse was again lost during transport to a nearby hospital. The victim's pulse was reestablished and lost several more times at the hospital before he was declared dead at 11:04 AM.

Machinery Load: The victim was operating a 20-ton P&H mobile crane. Below are listed the estimated boom positions:

- Boom radius - 35 feet
- Boom extension - 35 feet
- Boom angle- 45 degrees

Witnesses estimated the size of the granite boulder as 5 feet X 4 feet X 4 feet, and the "size of a small forklift." Based on this estimate the approximate volume of the boulder was 80 cubic feet. According to the CRC Handbook of Chemistry and Physics, the density of granite ranges from 165-172 pounds per cubic foot. The boulder's weight can be approximated as 13,000-14,000 pounds.

The weight of salt water is 64 pounds per cubic foot. Below the water's surface the weight of the water displaced by the boulder can be approximated at 5,000 pounds. Thus, as the boulder broke the surface of the water an additional load of 5,000 pounds was placed on the crane. Based on the crane's loading chart, the load capacity over the front of the machine was approximately 10,000 pounds. The side weight capacity of the crane was approximately 6,000 pounds. The total above surface weight of 13,000-14,000 pounds exceeds the load limit of either front or side loading (front loading =13,000-14,000 pounds minus 10,000 pounds = + 3,000-4,000 pounds; side loading = 13,000-14,000 pounds minus 6,000 pounds = + 7,000-8,000 pounds).

CAUSE OF DEATH
The death certificate indicated cause of death as "Asphyxiation as a consequence of flail chest; crush injury due to crane roll-over."

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should ensure that a system for accurately measuring loads to be lifted is used by crane operators prior to an attempted lift.
Discussion: The crane operator had no method of correctly measuring the weight of loads. In-cab digital instrumentation exists to accurately measure loads prior to an attempted lift. These devices should be retrofitted on all cranes. Without an accurate load weight, loading charts cannot be correctly interpreted by the crane operator.

Recommendation #2: Employers should ensure that crane operators are adequately trained in the use of load measuring devices, crane loading charts, and boom angle charts.
Discussion: Crane operators must be trained in the correct reading and interpretation of crane loading charts and boom angle charts. This information must be correlated with an accurate load weight measurement to be of any value. Crane operators need to know how to use in-cab digital instruments for weighing loads, and they must not exceed the load chart limits for the particular model of crane they are operating.

Recommendation #3: Employers should ensure that crane operators are aware of the effects of buoyancy on loads and the variable loading characteristics associated with loads in different surrounding media (e.g., water, sand, etc.)..
Discussion: The operator in this fatality had no formal training in crane operation that could be documented. He was also apparently unaware of the effects of buoyancy on boom loading. He placed the crane in its most vulnerable position by moving the load to the side of the crane after it broke the water's surface. The sudden increase in boom

loading at the weakest load-bearing area of the crane made it inevitable that the crane would become unbalanced.

REFERENCES

1. CRC Handbook of Chemistry and Physics, 73rd Edition, David R. Lide, Editor-in-Chief, 1992-1993.
2. Handbook of Engineering Fundamentals, First Edition, Ovid W. Eschbach, John Wiley & Sons, Inc., 1936.
3. Elementary Fluid Mechanics, Sixth Edition, Vennard & Street, John Wiley & Sons, 1982.
4. Personal Communications: Alaska Area OSHA investigative staff.
5. Personal Communication: NIOSH, Alaska Activity investigator.

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Fatality Assessment and Control Evaluation (FACE) Project

The Alaska Division of Public Health, Section of Epidemiology performs Fatality Assessment and Control Evaluation (FACE) investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR). The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

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