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Construction Worker Dies After Falling From a Wind Turbine Tower

Minnesota FACE Investigation 94MN01301

SUMMARY

A 29-year-old male rigger (victim) died after falling between 20-40 feet during wind turbine tower construction. He was wearing, but not using, a safety belt and lanyard at the time of the incident. The tubular, slightly tapered, turbine tower consisted of two vertical sections which were being bolted together. The bottom tower section had been set and the victim and two coworkers were attaching the top section. They were working from a pre-installed factory-manufactured work platform inside the bottom section, at approximately 50 feet. Access to the platform was by way of a pre-installed metal ladder, attached to the wall with heavy steel supports. Tower section interiors were cleared of snow and ice prior to setting; except for ice on the bolt flange which was removed, the tower's top section appeared clear. After attaching four bolts, the workers noticed additional ice and snow inside the top tower section. They decided there was insufficient accumulation to warrant its removal for further cleaning, and one coworker climbed up the ladder and began to dislodge it. A large chunk of ice fell to the platform and struck the other coworker's head. As the victim and injured coworker began descending the ladder to exit the tower, more ice fell from the sides of the top section, through the platform's ladder opening, and onto the men on the ladder. The victim was knocked from the ladder by the falling ice. As he fell, his head struck a steel ladder support and he sustained instant, fatal, head injuries. MN FACE investigators concluded that, in order to prevent similar occurrences, employers should:

- ensure workers use fall protection, even in emergency situations, when ascending/descending fixed ladders;
- cap wind turbine tower sections exposed to inclement weather to avoid ice build-up inside; and
- provide employees with adequate training to ensure that they can recognize potential hazardous exposures.

INTRODUCTION

MN FACE was notified of a March 2, 1994, work-related death of a rigger on March 3, 1994. MN OSHA, the county coroner, and the county sheriff were contacted and releasable information was taken. Copies of the sheriff's report and photos were obtained. A site investigation was conducted on March 4, 1994.

The victim worked as a rigger for a construction company erecting wind turbine equipment. The company had been on the 73-tower site for five months, working throughout the fall and winter months. Rigging began four months prior to the incident. The victim had been provided on-the-job training by his employer. The incident occurred about 10:00 a.m.

INVESTIGATION

A 29-year-old male rigger (victim) died from injuries incurred after falling from a ladder inside a wind turbine tower under construction. He and two coworkers (Coworker 1 and Coworker 2) were bolting two tower sections together when the incident occurred. All were equipped with hard hats and safety belts with lanyards. The 120-foot tall tubular, tapered tower consisted of a bottom and top section, 56 and 64 feet tall, respectively. The bottom section, already bolted to a base concrete pad, was 11 feet in diameter. It tapered to 9 feet at the top, where the two sections were connected using 36 bolts. A door at the base of the bottom section allowed access to the inside of the tubular structure. Inside, a pre-installed metal ladder, secured with heavy steel supports at 12-inch intervals, ran along one side of the section. Workers climbed the ladder with the wall at their backs and the steel supports at their sides. During construction, fall protection for riggers consisted of a safety belt and two lanyards equipped with clips to tie/clip off to the ladder rungs as they ascended or descended it. A cable climbing kit for self-retracting lifelines had not yet been installed behind the ladder as permanent fall protection. The ladder led to a pre-installed work platform at about 50 feet, where workers stood while bolting the tower sections together. See Figure 1. The platform's ladder opening, about 3-foot square, could be covered with a hinged metal cover after the platform was gained.

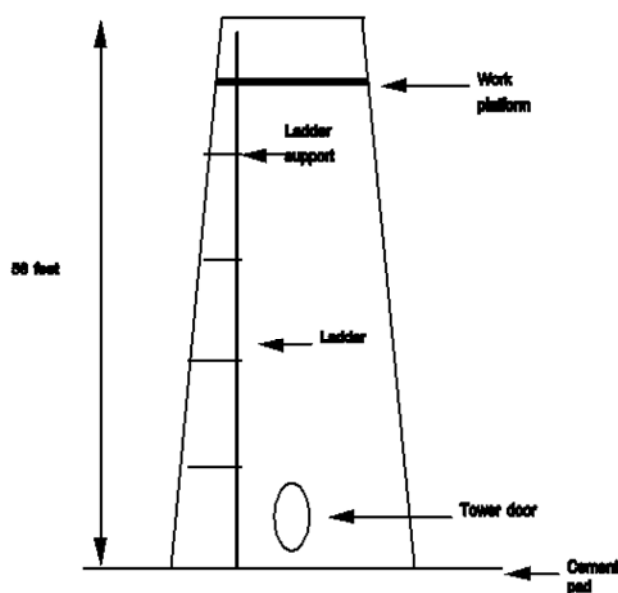


Figure 1.; Interior of bottom section of tower. Not to scale.

Tower construction began in the fall and proceeded throughout the winter. Before erection, sections were stored lying horizontally, open-ended, and unprotected on the ground. Tower erection protocol called for the dislodging of any snow or ice accumulation on or inside tower sections before sections were set by rapping on its outside walls with 3 lb. rubber mallets until the snow/ice was cleared out. Snow removal took place while the sections were held in a vertical position by a crane.

Except for ice on the bolt flange, which was removed, the tower's top section appeared clear. The top section was lifted into position, and the workers on the platform began bolting it into place. Four bolts were connected when the workers noticed more ice in the top section. They decided there was insufficient accumulation to warrant its removal; Coworker 1 climbed up its pre-installed ladder to dislodge it instead. A large chunk of ice fell to the platform and struck Coworker 2 on the head, knocking his hard hat off. Coworker 2 complained of feeling dizzy and the victim, also on the platform, notified crew on the ground that he and injured Coworker 2 were coming down; Coworker 2 descended the ladder first. Apparently, neither worker clipped off to ladder rungs during their descent. More large pieces of ice, estimated to be up to 1 foot square and 6 inches thick, suddenly let loose from the sides of the top section and fell through the platform's ladder

opening onto the men on the ladder. The victim, above Coworker 2 on the ladder at between 20-40 feet, was struck by the ice and knocked from the ladder. As he fell, his head struck a steel ladder support and he sustained instant, fatal, head injuries.

Other workers on site placed a 911 call immediately after the incident. The victim's falling body had knocked Coworker 2 off the ladder and landed on top of him; he required hospitalization for several days. Coworker 1 managed to avoid the falling ice and escaped major injury. No resuscitation was attempted on the victim after the incident.

CAUSE OF DEATH

The cause of death reported by the county coroner was severe head injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Ensure workers use fall protection, even in emergency situations, when ascending/descending fixed ladders.

Discussion: Because of the height of the fixed ladders in the towers, workers were required to use fall protection (safety belts equipped with lanyards) during ascent and descent. During project start-up, in fact, it had been necessary to equip lanyards with larger clips to accommodate the towers' ladder rung size. In addition to making any necessary mechanical adjustments during start-up, and as part of fall protection training, employers should address appropriate procedures to use in emergency situations. The urgency of this situation demanded that the workers leave the tower as quickly as possible, but both the injured coworker and the victim should have used the supplied fall protection as they descended the ladder. In addition to the falling ice hazard, the injured coworker, feeling weak and dizzy, could have lost consciousness and fallen.

Recommendation #2: Cap wind turbine tower sections exposed to inclement weather to avoid ice build-up inside.

Discussion: Tower sections were stored lying horizontally, open-ended, and unprotected on the ground prior to erection. Open ends could be securely capped with a tarpaulin or similar covering to prevent snow from entering during winter months. This procedure, in addition to eliminating the hazard which caused this incident, may actually save time during tower erection.

Recommendation #3: Provide employees with adequate training to ensure that they can recognize potential hazardous exposures. This recommendation is in accordance with CFR 1926.21(b)(2).

Discussion: Employers should provide employees with adequate training to ensure that they can recognize potential hazardous exposures. The interior of tower sections were painted white, and snow and ice accumulation may have been difficult to see and/or assess, especially when they were hanging in a vertical position. Training should, therefore, emphasize that dislodging ice above workers who may be in the tower is always hazardous and should be avoided. When new company procedures or guidelines are developed or existing ones are modified, employers should ensure that workers are provided with appropriate supplemental training.

REFERENCES

1. Office of the Federal Register, Code of Federal Regulations, Labor, 29 CFR Part 1926.21(b)(2), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., July 1, 1992.

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