

MIFACE INVESTIGATION REPORT: #10MI019

SUBJECT: Farmer Died When He Fell From a Ladder

Summary

In the Winter of 2010, an 83-year-old male farmer died when he fell from a ladder in a cattle pen while he was replacing boards for a heifer pen (Figure 1). The decedent had noted that the nominal dimension oak lumber (2x4s, 2x6s) boards on the fence between the concrete cattle courtyard and the heifer pen “gave way” when pushed against. The fence was located on the north side of the heifer pen. The event was unwitnessed. Cattle were in the courtyard. The decedent disassembled an extension ladder and



Figure 1. View of incident scene

was using the 12-foot fly section (the ladder section that can be extended upward) to gain access to the fence boards. It appears he was using a battery operated drill, described as fairly new, to drill pilot holes for additional fasteners. When the decedent did not come back for dinner, his spouse looked for him. She found him lying on his side on the ground, unconscious but breathing. The ladder had fallen to the east. The drill bit had broken. His wife tried to use her cell phone to call a friend and emergency response, but her cell phone would not place the call. Finally, she was able to contact 911. A helicopter was summoned and the decedent was taken to a nearby hospital. He died the next day as a result of the injuries sustained.

RECOMMENDATIONS

- Follow safe ladder work practices; extension ladders should not be separated and use ladders equipped with safety feet.
- Clear unrestrained animals from work area prior to beginning work.
- When using fasteners like nails or screws, drill appropriately sized pilot holes and use appropriately sized fasteners.
- Ensure emergency response can be summoned on a timely basis.

INTRODUCTION

A MSU Extension agent notified MIFACE personnel of this fatality. MIFACE contacted the decedent's spouse who agreed to participate in the research program. MIFACE personnel conducted a site visit on September 23, 2010. The police report, medical examiner case report, and the death certificate were reviewed. An autopsy was not performed. The decedent's wife permitted MIFACE to take pictures of a scenario re-enactment of the incident.

The decedent was raised on a farm, but worked in a non-farming activity until retirement. After the decedent retired, he bought a farm and raised short horn cattle. The farm comprised 250 acres. The decedent, at the time of the incident, had seven calves and seven heifers. The calves were raised for breeding purposes. The decedent sold the calves once per year, and occasionally sold the heifers. The decedent did not have employees. He had attended numerous MSU Extension courses, and was considered a "progressive farmer" by his community. His wife indicated that the decedent would ask her for help if he felt the job required her assistance.

The decedent had past surgeries for his heart, back and eyes. He was a well-controlled diabetic, and strictly followed his prescribed insulin and eating regimen.

INVESTIGATION

On the day of the incident, the temperature was approximately 55⁰F with wind speeds from the north/northeast ranging from 9 mph to 16 mph. Wind gusts occurring near the time of the incident were approximately 20 mph. Minimal amounts of snow had fallen the previous week and the snow had melted. The concrete courtyard was dry. The courtyard sloped slightly downward. Measurements where the ladder was found: 58 inches height from heifer pen floor to where he was drilling and 64 inches from concrete courtyard to board he was drilling.

Due to the cool but not cold weather, the decedent was dressed in 6-inch lace-up Muck® boots with bottom treads, several pairs of socks, shirt, sweatshirt and hooded sweatshirt. He had eaten lunch and came in for a snack between 4:00 p.m. and 4:30 p.m. He then returned to work.

Barn maintenance was ongoing throughout the year. The decedent was getting ready for the birthing season and was repairing the heifer barn fence. He had tested the heifer pen fence boards, which were attached on the north side of the support heifer pen support poles (facing the cattle courtyard). The top of the lower fence board



Figure 2. Fence board/post where some pilot holes had been drilled.

was 64 inches above ground level. The boards separated the heifer pen from the cattle courtyard. These boards “gave way” and were not attached securely (Figure 2). He gathered his tools; a fairly new battery operated drill and his favorite ladder, the 12-foot top section of an extension ladder that had been separated from the ladder base.

The 12-foot fly section of the ladder had straight, not angled ends. It is postulated that the decedent was in the process of drilling pilot holes through the existing fence boards attached to the support posts or working on the building’s upper beam so he could place fasteners (nails or screws). He did not remove the cattle from the courtyard. It is unknown how high the decedent had climbed the ladder; it is unknown if he was placing support screws in the building beam or in the fence. It is unknown how he set the ladder against the fence; ladder may have been supported only by the lower fence rail or supported by both the lower and upper beam. Also unknown is the position of the ladder in relation to his work activity; it is unknown how far he may have been leaning to drill the pilot holes. Also unknown is if the ladder was placed so the ladder’s rung locks were at the top or near the ground (Figures 4 and 5 show both options). At some point during his work activity, he fell from the ladder and struck his head on the cement courtyard.



Figure 3. Ladder used by decedent with no safety feet

When he did not return for dinner, his wife took her cell phone and went to look for him. She found him lying on his side to the west of the ladder, with his knees drawn up in the courtyard, like he was attempting to get up after a fall. He was unconscious, but breathing. The ladder had fallen to the east. His drill bit had broken.

His wife attempted several times without success to contact a neighbor and emergency response. After several tries, she was finally successful in contacting emergency response. Based upon her description, emergency response called for a helicopter and an ambulance was dispatched.



Figure 4. Ladder placed under (not supported) by the building beam and against fence railing

When the ambulance arrived, emergency responders placed the decedent in the ambulance until the helicopter arrived. She was not granted access to the ambulance.

The helicopter transported the decedent to a nearby hospital where he died the following day.

Several incident scenarios were developed:

1. He had a medical emergency causing his fall. No autopsy was performed to rule out a medical emergency.
2. While drilling, he may have struck a knot or nail with the drill bit, causing him to be pushed back and the ladder kicking out resulting in a fall from the ladder and the ladder to fall.
3. One of the cattle pushed against the ladder, causing the ladder to move. He may have lost his balance and he and the ladder fell.
4. One of the cattle came between the heifer pen and the ladder causing the ladder to be pushed away and the decedent and the ladder to fall.
5. The top of the extension ladder segment was not placed against the heifer pen beam, thus supported only by the 2x4 fence board. The extension ladder segment had a straight cut and did not have safety feet so the ladder base was not flush with the concrete. The ladder base may have kicked out more easily as he was working and applying pressure to the drill (Figure 4).
6. Wind gust may have affected his balance on the ladder.



Figure 5. Top of ladder resting against the upper beam of barn

CAUSE OF DEATH

The cause of death as listed on the death certificate was craniocerebral trauma. No autopsy or toxicology was performed.

RECOMENDATIONS/DISCUSSION

- Follow safe ladder work practices; extension ladders should not be separated and use ladders equipped with safety feet.

Although agriculture is exempt from many MIOSHA standards, farmers should use the standards to learn more about safe work practices. The MIOSHA Construction Safety Standard, Part 11, Fixed and Portable Ladders specifies the requirements for ladder use.

Extension ladders should not be separated. Using the upper section without angled feet defeats the function and safety of a modern extension ladder. Old wooden extension ladders, such as the one the decedent had separated, may not have the latest adjustable safety foot. Ladder safety feet increase the ladder's "grip" on the ground and are found on the newer versions of extension ladders.

Many organizations have published and/or posted on the Internet safe ladder use practices. The decedent's actual work practices, except for separating the ladder, were unknown. Based on the activity, several additional work practices that may have contributed to this tragic incident are identified in the table below.

<p>Ladder placement against the heifer barn may not have been the appropriate pitch.</p>	<p>A portable ladder's safest pitch is when the horizontal projected distance from the top support to the base is not more than 1/4 of the vertical distance between these points. The more outward the base is moved from this position, the greater the risk that the ladder will slip outward and fall. When the base of the ladder is closer to a straight up and down position and used at a steeper angle, the ladder is at risk of toppling backwards when the worker leans away from it or losing its grip on the ground.</p>
<p>The ladder did not have safety feet nor was the ladder secured.</p>	<p>Safety feet and securing a ladder provides stability by minimizing ladder movement. The force exerted by the decedent as he was drilling the pilot holes may have put a side load on the ladder, causing the ladder to slip/move because the base (feet) end was not flush with the concrete.</p>
<p>Ladder placement not against heifer pen building beam.</p>	<p>To enhance safety, in addition to a properly angled ladder, four-point contact should be maintained. It is unknown if the decedent placed the ladder against the building beam. If he did not, then there would not be the necessary four-point contact with the working surfaces and this could have contributed to the ladder kicking out.</p>
<p>Maintaining three-point contact with the ladder.</p>	<p>Safe ladder use requires a worker to maintain a three-point connection (two hands/one foot or two feet/one hand) and his/her shoulders within the side rails. He may have had to use two hands to control the drill.</p>

- Clear unrestrained animals from work areas prior to beginning work.

Although the cattle were accustomed to the decedent's presence in the herd, the decedent was performing a work activity that was "new" to the animals. He was on a ladder and using a drill that made a sound with which they may not have been familiar. Animals roaming in the area of the ladder provided an additional distraction to the decedent as he attempted to drill the pilot holes. The weight of the animals could easily move or dislodge a ladder from its position, causing the decedent to lose his balance and fall. To ensure safety of both the animal and human, unrestrained animals should be moved to another area or restricted from the work area.

- When using fasteners like nails or screws, drill appropriately sized pilot holes and use appropriately sized fasteners.

Figure 2 shows that nails were used to secure the fence lumber to the post. Nails offer shearing strength however drilling the wrong pilot size hole could allow easier nail withdrawal and less security than screws of the appropriate size and length. In hardwood lumber, correctly sized pilot holes are usually recommended prior to any nail or screw.

Construction deck screws as well as nails could have been used by the decedent to reinforce the fence connection to the support post. When deciding on which nail to use, remember that a nail's strength is based on its length and its diameter. Given the proper length, the nail can be driven far enough into the supporting member so the nail has its maximum allowable lateral strength. The strength of a properly placed nail is also dependent on its diameter as this affects the quantity of wood fibers that can bear against its surface. The "wider" the nail (greater diameter), the more wood fibers can bear, the stronger the connection. The nail length selected should be approximately three times the thickness of the board. A nail driven perpendicular to the grain should penetrate the lumber a minimum of 12 times its diameter. Building codes often call for at least half the length of the nail.

Note that the type of nail (for example, box, common, cooler, gypboard) determines its diameter (diam). Therefore, choosing the proper type of nail for the application required is necessary. The nominal size of a 2x4 is 1½ inches. #20d box and common nails are both 4 inches long and each would penetrate the post approximately 2.0 inches. There is quite a difference in their connection strength because the common nail had a greater diameter.

Nail Specifications (Units in inches)											
Box	Length	Diam.	Common	Length	Diam.	Cooler	Length	Diam.	Gypboard	Length	Diam.
2d	1	0.067	2d			2d	1	0.062	2d		
3d	1.25	0.076	3d			3d	1.125	0.067	3.25d	1.1875	0.080
4d	1.5	0.080	4d			4d	1.375	0.080	4d	1.375	0.080
5d	1.75	0.080	5d			5d	1.625	0.086	5d	1.625	0.086
6d	2	0.099	6d	2	0.113	6d	1.875	0.092	6d	1.875	0.0915
7d	2.25	0.099	7d			7d	2.125	0.099	7d	2.125	0.099
8d	2.5	0.113	8d	2.5	0.131	8d	2.375	0.113	8d	2.375	0.113
9d	2.75	0.113	9d			9d	2.625	0.113	9d		
10d	3	0.128	10d	3	0.148	10d	2.875	0.120	10d		
12d	3.25	0.128	12d	3.25	0.148	12d			12d		
16d	3.5	0.135	16d	3.5	0.162	16d			16d		
20d	4	0.148	20d	4	0.192	20d			20d		

- Ensure emergency response can be summoned on a timely basis.

The decedent’s wife had difficulty contacting emergency response based on her location. Farm owners should ensure that, if using cell phones for communication that the phones work on all areas of their farm. If the cell phone does not work at all work areas, then other communication options, such as walkie-talkies should be explored.

RESOURCES

MIOSHA standards cited in this report may be found at and downloaded from the MIOSHA, Michigan Department of Licensing and Regulatory Affairs (LARA) website at: www.michigan.gov/mioshastandards. MIOSHA standards are available for a fee by writing to: Michigan Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, P.O. Box 30643, Lansing, Michigan 48909-8143 or calling (517) 322-1845.

- MIOSHA Construction Safety Standard, Part 11, Fixed and Portable Ladders
- MIFACE Investigation Report #07MI007: Subject: Carpenter Dies After Fall From a Ladder That Slipped From Its Base While Positioned on Frozen Sand <http://www.oem.msu.edu/MiFace/07MI007.pdf>
- WeatherUnderground data for the incident location and day. <http://www.wunderground.com/>
- MIFACE Investigation Report: #07MI136: Subject: Hotel Assistant Manager Dies Due to a Fall from a Ladder During Installation of Wood Trim <http://www.oem.msu.edu/MiFace/07MI136.pdf>

- MIFACE Investigation Report: #07MI122: Subject: Farmer Killed When He Became Entangled in Implement Drive Line/Posthole Auger <http://www.oem.msu.edu/MiFace/07MI122.pdf>
- Nail Size Chart – Engineers Edge. http://www.engineersedge.com/nail_size_chart.htm
- Nails. <http://www.sizes.com/tools/nails.htm>
- The Right Nail for the Job. <http://www.mcvicker.com/offtech/smnail.htm>
- Wikipedia - Ladders. <http://en.wikipedia.org/wiki/Ladders>

KEY WORDS: Fall, ladder, cattle, farmer, agriculture

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