MIFACE Investigation Report #11MI059

Subject: Hispanic Farm Laborer Struck by 550-gallon Water Tank When Wood Support Structure Collapsed

Summary

In the spring of 2011, a Hispanic male farm laborer in his 60s died when an elevated wooden structure with a nearly full 5½-foot diameter by 3½-foot tall plastic, 550-gallon water tank gave way causing the water tank to land on him. Both the decedent and the farm owner were on the incident site but working on independent tasks on opposite sides of the 13-acre blueberry/potted plant farm operation. The water tank was located on top of a storage platform built by the decedent approximately three years previously. The storage platform was constructed of construction common-grade lumber. Four 4"x 6" corner posts were 52" tall and flush with the ground. For both the upper platform to support the water tank and the bottom platform to provide off-ground storage, the decedent used 2x6 wood planks. A polyethylene plastic material was installed to cover three sides of the structure to create and protect the storage area under the upper platform/tank. The nails used for the structure's assembly were not galvanized nails. The event was not witnessed. The sheriff's office determined that the wooden platform collapsed on the decedent and pinned him under the water tank, perhaps while he was retrieving tools. The owner heard the sound of the crash and came to the area where he found the decedent under the tank. The owner called a neighbor who then called for emergency response. Emergency response arrived and the decedent was transported to a local hospital where he died several days later from the injuries sustained at the time of the incident. A beer can was found at the structure's open side.

Figure 1. Overview of incident scene after moving the tank from the decedent

Contributing Factors

1. Water tank weighing approximately 5,000 pounds fell onto decedent.
2. Improper construction of support structure.

RECOMMENDATIONS

- Outdoor rigid frame structures/platforms constructed with outdoor-rated, pressure-treated lumber should have the appropriate lumber strength, bracing, and fasteners to withstand at least two times the weight of the supporting mass.
- Farm-built, outdoor, pressure-treated lumber wood support structures should be inspected at least annually for evidence of wood decay and structural deficiencies.
- Employers should consider measures that contribute to a drug-free work environment, including the development and implementation of an alcohol-and drug-free workplace program, particularly for jobs related to machine and motor vehicle operation.

BACKGROUND

In the spring of 2011, a Hispanic male farm laborer in his 60s died when an elevated wooden structure with a nearly full 5½-foot diameter by 3½-foot tall plastic, 550-gallon water tank gave way causing the water tank to land on him. MIFACE was notified of the incident initially by a newspaper clipping and then by the MIOSHA 24-hour fatality hotline. MIFACE contacted the farm co-owner and an onsite MIFACE investigation was conducted. The MIOSHA investigation file and the sheriff's and medical examiner's reports were reviewed. Pictures used in Figures 1–4 are courtesy of the responding sheriff department.

The farm owner, who spoke fluent Spanish, identified the decedent as a farm laborer whose primary language was Spanish. The owner considered him his partner in the farm operation. The farm owner had operated the 13-acre farm for the past 15 years, growing 10 acres of blueberries and 3 acres of potted plant material. The decedent worked the Michigan operation and lived with the farm's owner from October through March. From April through September each year he worked in Texas. The farm did not have any full time workers. The owner indicated that he used a packaging firm, who supplied farm laborers to pick the blueberries. The packaging firm trained and paid the workers.

The farm owner had not attended any formal farm safety classes nor did he have a written farm safety plan.

The MIOSHA General Industry Safety Division personnel did not issue the farm owner a citation of violation of a MIOSHA standard at the conclusion of its investigation.

INVESTIGATION

Prior to the support structure being constructed, the plastic 5½-foot diameter by 3½-foot tall, 550-gallon water tank rested on a wagon in the middle of the farm's 13 acres. The decedent thought that the wagon took up too much room and wanted to free up this space, so he built the support structure involved in the incident. The farm owner disagreed with this idea, but because

of their friendship and cooperative working relationship, he permitted the decedent to build the structure.

Figure 2. Overview of incident scene

The decedent built the structure approximately three years ago (2009) in the same location as the wagon. He used construction common-grade (non-pressure-treated) wood. The four 4" x 6" corner posts were 52" long. The upper platform supporting the water tank and the lower platform used as off-ground storage for tools were constructed with 2" x 6" wooden planks. The tank was located 4' 6" above the ground. A polyethylene plastic material was installed to enclose the south, east and west sides of the structure, leaving a north access to the created and protected a storage area under the upper platform/tank. The nails used for the structure's assembly were standard non-galvanized nails. The decedent did not sink the corner posts in the ground or use cross-bracing.

The farm owner informed the MIFACE researcher that the upper platform was not much bigger than the 5½-foot diameter base of the water tank. He also stated that the water tank was nearly full – estimating that it contained approximately 500 gallons of water at the time of the incident. The tank had a valve and piping located on the bottom edge of the side for dispensing water. There was a fill lid located on the top of the tank.

The decedent arrived to the farm at approximately 9:00 a.m. The decedent and the farm owner were working independently. The owner did not know what tasks the decedent was performing at the time of the incident. Weather conditions were not a factor in this incident.

Figure 3. Water tank with hole in side

The sequence of events was unwitnessed. The owner and the responding sheriff department hypothesized that the decedent was retrieving some items within the storage area under the tank when the structure collapsed. One corner post was broken. The post either broke, causing the structure to collapse and the water tank to fall, or the post broke during the water tank's fall. The tank fell toward the open side that allowed access to the stored material. When the structure collapsed, the crash was

heard by the farm owner who was working in the far back northeast corner of the field. He found the support structure to be collapsed and the decedent under the water tank.

The farm owner called a friend who owned a nearby nursery; this individual called for emergency response. The MIOSHA file indicated that the friend called for emergency response while driving to the incident site. Due to his accent, the friend informed the MIOSHA compliance officer that central dispatch had a hard time understanding him and due to the frantic nature of the phone call from the farm owner, he could not accurately inform central dispatch what had occurred.

While emergency response was summoned, the farm owner used a shovel to poke a hole in the water tank to drain the water so he could move the tank from the decedent (Figure 3).

CAUSE OF DEATH

The cause of death as listed on the death certificate was multiple blunt force injuries of the chest and abdomen. An autopsy and toxicological tests were not performed.

RECOMMENDATIONS/DISCUSSION

- Outdoor rigid frame structures/platforms constructed with outdoor-rated, pressure-treated lumber should have the appropriate lumber strength, bracing, and fasteners to withstand at least two times the weight of the supporting mass.

The stability of a structure depends on how the structure is constructed, including the type of wood, fasteners and structure geometry. The structure that collapsed may have been built as shown in Illustration 1. This type of structure is called a rigid frame, that is, its members are so connected that the angles they make with each other do not change under load. The structure gains its stability from rigid joints.

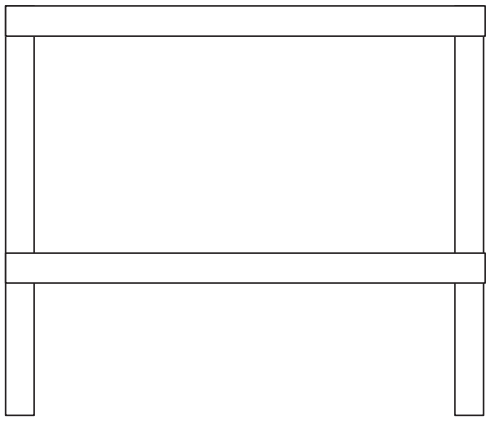

Illustration 1. Rigid frame structure

It is very difficult to construct such a structure using only wood and nails. Wood structures must have additional diagonal bracing in order to resist the bending forces at the joints. A type of diagonal bracing is as shown below in Illustration 2.

All four sides of the structure need diagonal bracing. The bracing should create an X pattern on the structure. This pattern will have one member in compression and one in tension at all times under the loading. The bracing needs to be fastened using screw or bolt through fasteners with washers. Each fastener should be of appropriate size for the load. Normally the floor is nailed to the frame. If not, then there should also be an X type of bracing in the horizontal plane. Just setting this wood structure on level ground requires X type of bracing of the posts at the ground contact point. This X type of bracing on the level ground helps to stabilize vertical posts. If using traditional pole barn construction techniques for a structure like this, the vertical posts should be set below the frost line with pads below the vertical posts of the correct size of materials for the anticipated load.

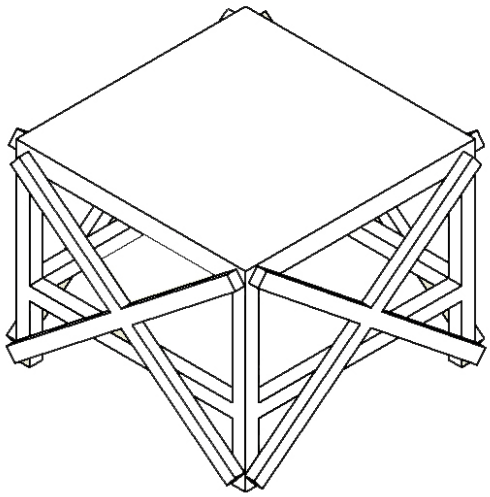

Illustration 2. Bracing pattern necessary to provide stability

If using steel construction techniques, a steel gusset plate should be welded in the correct location to achieve the necessary diagonal strength at the joint.

When estimating the load of the tank, water weighs approximately 8.33 pounds per gallon. In this case, a 550-gallon tank filled with water would weigh 4,582 pounds. The load would also include the weight of the empty tank, the wooden platform, and stored materials. The total weight would be used in the calculations for material sizes such as posts and pad area. The US Forest Products Laboratory wood strength chart (http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr190/chapter_05.pdf) could assist the farmer to select the appropriate construction materials. **Professional help may be needed to design and build this type of structure.**

- Farm-built, outdoor, pressure-treated lumber wood support structures should be inspected at least annually for evidence of wood decay and structural deficiencies.

Farmers should inspect, at least annually, the structure to identify wood deterioration, insect activity and/or rot or other related deterioration. If any type of deterioration is noted, the farm should consider hiring a registered professional engineer to provide an expert opinion regarding the structure's structural integrity.

- Employers should consider measures that contribute to a drug-free work environment, including the development and implementation of an alcohol-and drug-free workplace program, particularly for jobs related to machine and motor vehicle operation.

The police pictures taken at the scene show a beer can next to the collapsed structure (Figure 4). It is unknown if the can was empty and had been there for a period of time or if it was a can from which the decedent had been drinking.

The employer did not have an alcohol and drug-free workplace program. Even small operations with few employees should consider designing and implementing an appropriate alcohol- and drug-free workplace program that matches the needs of their organization.

Figure 4. Beer can found at scene

Currently, there is no specific MIOSHA standard on this issue. Employers can create a drug- and alcohol-free workplace policy for their business by utilizing the U.S. Department of Labor's Drug-Free Workplace Adviser. The Advisor has 13 sections with questions that are completed by the employer. At the conclusion of the Advisor, a drug- and alcohol-free workplace policy is created based upon employer selections. The U.S. Department of Labor strongly recommends that a legal consultant, such as a labor/employment attorney, review the created policy prior to distribution and implementation. Employers may also find it useful to research how similar businesses and industries in their local area have addressed this issue.

If a farm has vehicles that require a commercial driver's license, the drivers of such vehicles are required by Department of Transportation (DOT) and Federal Motor Carrier Safety Act (FMSCA) regulations to be in a drug and alcohol testing program.

ACKNOWLEDGEMENT

MIFACE would like to acknowledge the assistance of Dr. Larry Segerlind, PhD, P.E., an agricultural engineer with over 50 years of experience in the structures area and Professor at Michigan State University.

KEY WORDS: Wood structure collapse, water tank, Hispanic, Agriculture

RESOURCES

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- Ogg, Barb PhD. *Choose Wood Materials Carefully To Prevent Termites and Rot.* University of Nebraska-Lincoln Extension Educator. http://lancaster.unl.edu/pest/resources/woodchoices.shtml

- US Department of Labor: Drug Free Workplace Advisor. http://www.dol.gov/elaws/drugfree.htm
- Kretschmann, D.E. Wood Handbook, Chapter 5, *Mechanical Properties of Wood*. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 5-1 - 5-46. Chapter 5. http://www.fpl.fs.fed.us/products/publications/specific_pub.php?posting_id=17965&header_id=p

 June 4, 2013