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The massive chunk came loose from the wall too quickly for Mr. Douglas to get out of the way.

The frozen silage struck him in the head and back, throwing him forward onto his stomach and his head into the metal silo unloader.

His head struck the machinery with such force it fractured his face in 16 places, but it also saved his life. The frozen silage that fell on his back and legs propped against the silo unloader, leaving a 10-inch gap that allowed Mr. Douglas to get air.

"He would have suffocated if it wasn't for the silo unloader," Mrs. Douglas said.

After briefly being knocked unconscious, Mr. Douglas awoke and realized his predicament. He hollered loudly for help, but quickly composed himself, understanding he needed his energy if he wanted to leave the silo alive.

"I realized I could scream all I want, but there is nobody down there," Mr. Douglas said. "I started thinking about what I had to do to survive."

Mr. Douglas was alone on the 750-acre farm, but he knew his wife would be home about 12:30 p.m. after she finished her morning duties as an elementary school library volunteer in Elk Mound.

When Mrs. Douglas arrived home she didn't find her husband, so she had lunch and a couple of hours later kept a chiropractic appointment in Elk Mound. She picked up daughter Sara, 15, after school for an orthodontist's appointment and they arrived home again at 4:30 p.m.

Son Brian, 17, was at an FFA activity, so Mrs. Douglas and daughters Sara and Megan, 12, started the nightly milking and other chores.

Now worried about her husband, Mrs. Douglas prepared to look for him around the farm. Sara volunteered to help.

Up in the silo, Mr. Douglas had tried to remain alert. He periodically hollered for help and struggled to move the silage chunk from his back.

Mostly, though, he tried to conserve his energy in case someone wandered by the silo.

At about 6:50 p.m., Sara called for her father as she walked past the silo. She heard a muffled voice coming from inside. She couldn't understand the words, but knew it was her father and hollered back.

With the sound of his daughter's voice, Mr. Douglas knew his seven-hour ordeal nearly was over.

"Thank God," he thought, "I might make it."

Sara ran to her mother, who quickly climbed the silo in the dark to find her husband. After a brief conversation, Mrs. Douglas called 911 and, following her husband's instructions, pushed the button to try to raise the silo unloader off of him. The unloader didn't move.

Mrs. Douglas grabbed a flashlight and climbed the silo to her husband's side.

"I could see blood on his head," she said. "I could see his arms, legs and shoulders stuck underneath him somehow."

She reassured her husband that help was on the way.

Wayne Lutz, Elk Mound assistant fire chief, was at home when he got the emergency call that a man was trapped in a silo. He didn't know, though, that the farmer was his wife's cousin and his sixth-grade daughter Trisha's basketball coach.

At the Douglas farm, Mr. Lutz found Mrs. Douglas at the base of the silo and immediately climbed up to find Dunn County Sheriff's Deputy Scott McRoberts already with Mr. Douglas.

"I couldn't believe he was alive," Mr. Lutz said. "He was pinned so far back in you couldn't even see him. I couldn't make out his face or anything.

"I've seen people in head-on traffic collisions who haven't been pinned in that badly. He was completed squashed."

Mr. McRoberts tunneled through the silage and placed an oxygen mask on Mr. Douglas' face.

Two additional Elk Mound firefighters soon were in the silo. The emergency workers reasoned it would be impossible to dig Mr. Douglas out from under the silage, so they decided to chip it with fire axes and pry bars.

They found the frozen mass to be "as big as my living room," Mr. Lutz said.

The workers worked carefully, chipping away small 2-inches pieces. They feared even a small piece of the frozen chunk could kill Mr. Douglas if it fell on him.

"If you broke off a chunk a foot by a foot, it took two men to carry it," Mr. Lutz said.

After about 20 minutes of digging, the workers could touch Mr. Douglas. They cut an opening large enough to lift him out and place him on a medical backboard.

Soon three emergency workers from the Menomonie Fire Department were in the silo and working on the farmer's injuries.

About 40 minutes later, rescue workers used a rope to lower Mr. Douglas, strapped onto a board, to an ambulance that rushed to

Luther Hospital.

Mr. Lutz was left to think about Mr. Douglas' remarkable survival in the silo for seven hours.

"There was no doubt in my mind that if it had fallen any other way, direction or place, it would have killed him," Mr. Lutz said. "It was a miracle he lived through that.

"Thank God miracles happen every day. It's obvious somebody was watching out for him."

When the ambulance arrived at Luther Hospital, Mr. Douglas' temperature had dropped to 94 degrees and the level of acid base in his bloodstream was dangerously low because of the massive injury to his legs, said Dr. David Ciresi, a Luther surgeon.

"He had critical injuries; there's no question about it," Dr. Ciresi said.

Remarkably, Mr. Douglas had no broken bones in his legs or major internal bleeding.

But Dr. Ciresi was concerned Mr. Douglas' muscles had started to die in his legs because of the lack of blood flow caused by the hours he was pinned under the silage.

In six places, doctors cut the muscle linings in his upper and lower legs to allow blood to flow through arteries to his legs.

Mr. Douglas was placed on a ventilator to relieve the stress on his body.

Twenty-four hours later, his kidneys started to fail and Mr. Douglas was placed on a dialysis machine. He was on the machine for the next 2½ weeks until his kidneys started working again.

As his condition improved, he began physical and occupational therapy to regain his independence.

"His attitude has been great," said Luther occupational therapist Crystal Boylen. "As much as this man has been through I'm so impressed with his will to live and his will to return home and to fight to get back to his life.

"It's unbelievable how much he's gone through."

Ms. Boylen started working with Mr. Douglas on Feb. 26, two weeks after the silo accident. She works to strengthen the upper body of the once-muscular farmer so he can more easily transfer himself from his bed to a wheelchair.

The former marathon runner's muscles had started to atrophy from lack of use. The muscles need to be rebuilt. He has therapy up to twice a day to work on his muscles.

Mr. Douglas has had multiple operations on his legs and a skin graft on one of the incisions. Doctors removed a third of his left thigh muscle because of damage from the extended time the leg was under his body in the silo.

Mr. Douglas has movement in both legs, with more strength on his right side. He remains "fairly weak," his doctor said, but uses a walker and is working with a cane.

"It's hard to say where he'll wind up," Dr. Ciresi said. "It's too early to tell."

Mr. Douglas had no brain damage despite eight fractures in his forehead, six to his cheek and two to his nose.

Dr. Ciresi called his vision "totally amazing" considering the damage around his right eye where he struck the silo unloader. Mr. Douglas said he has some blurred vision in the eye, but is happy with the limited damage.

"Being young and being active definitely were in his favor," Dr. Ciresi said. "If this would have happened to a 70-year-old, he probably wouldn't have survived."

Dr. Ciresi called Mr. Douglas' family an "amazing support group that often times you don't see with trauma patients. They are a super nice family."

Jim Holte was returning to his rural Elk Mound home the night of Feb. 12 when he saw the lights of the emergency crew at the Douglas farm. He stopped and learned about the silo accident and that his neighbor had just been taken to the hospital.

Mr. Holte, 47, has farmed much of his life and knows firsthand about farm accidents. He'd had narrow misses himself and tragically, less than two years ago, his father, Gerhard, 79, was killed in a tractor rollover.

"It's a dangerous occupation," Mr. Holte said. "With all the equipment, and there is a certain amount of unpredictability with the animals. And it's not unusual for farmers to work alone or nearly alone."

Like many others, Mr. Holte stopped at the Douglas farm the next day to lend a hand. Like his neighbors, he returned many more times to help milk cows or perform other arm chores.

"It's something neighbors do," Mr. Holte said.

The Douglas family certainly noticed. Clyde and Margaret Douglas had returned from their winter home in Arizona after hearing about their son's accident, and found their friends and neighbors helping out in a time of need.

Margaret Douglas praised everyone who has helped out with the farm since her son's accident.

The outpouring of care and concern from friends, family and neighbors is overwhelming to the Douglases.

"Sometimes you think, 'What did I do to deserve this?'" Mr. Douglas said of the generosity.

Mr. and Mrs. Douglas sold the family's 72 milk cows two weeks ago, but plan to raise corn and snap beans on the 750 acres of land they own.

Mr. Douglas said he knew he would not be able to maintain the dairy herd.

"If you can't do it, you can't do it," he said. "It was the right decision."

Mr. Douglas' friends in the Chippewa Valley running community haven't forgotten him either.

He was known as a physically strong runner, a frequent winner in Indianhead Track Club events in the Chippewa Valley. Mr. Douglas was a top marathoner, competing in five 26.2-mile runs in eight months in 1994-95. One of the runs was his win in the Lake County Marathon in suburban Chicago, where he finished in 2 hours, 36 minutes. His best marathon time was 2:31.

"When he was at his peak he was as tough as anybody," said Fred Hable, a friend and fellow Indianhead Track Club member.

Mr. Hable has visited Mr. Douglas in the hospital several times since the accident.

"What surprised me was after two weeks (after the accident) he had such a good attitude," Mr. Hable said. "I can't imagine being in that situation and being as positive as he was."

That positive power also impressed running friend Neil Camrud of Eau Claire, who sees Mr. Douglas about every two days.

"He's a fighter," Mr. Camrud says. "He told the physical therapist to push him until he can't take it anymore.

"He has the amazing ability to a take the situation he was handed and make the best of it. That's what he's doing right now."

Mr. Douglas' friends have organized a fund-raiser at the Spring Fever 6 Run in Altoona on Saturday, April 21. Proceeds from the Indianhead Track Club race will go to a fund for Mr. Douglas, and there will be a free-will offering. Lutheran Brotherhood will provide a two-to-one match for donations, with the organization donating up to $1,200.

Doctors say Mr. Douglas can leave the hospital after his thigh improves, but there is no timeline. They say the next six months to a year will determine what, if any, limitations he will have on his legs.

Mr. Douglas plans to resume farming and said he looks forward to the day he can sit on a tractor and work the fields of rural Elk

Mound.

As for running, that remains a question mark.

"Medically, I think that it would be unlikely he could run a marathon, but it's not out of the question," Dr. Ciresi, his doctor, said.

FACE INVESTIGATION # 99WI05501

SUBJECT: Farmer Dies After Tractor Overturns and Pins Him Beneath Tractor Seat

SUMMARY: An 49-year-old male part-time farmer (the victim) died when the tractor he was using to uproot a small tree overturned on him. The victim was clearing an old cherry orchard that was no longer used for commercial purposes, to prepare the property for other uses. He had previously removed trees with a chain saw, and dug out the stumps afterward. His 1942 Ford 9N tractor was not fitted with ROPS. The victim attached a chain to the base of a small cherry tree, and the other end to the base of the operator's seat. He was in the operator's seat, and apparently accelerated the tractor to pull on the tree. The tractor flipped over backwards, and the farmer was pinned between the seat and the ground. His wife had been waiting for him to join the family for supper, and went to the field when he failed to return. She found him beneath the tractor, and called for emergency services. The victim was pronounced dead at the scene by the medical examiner. The FACE investigator concluded that, to prevent similar occurrences, farm tractor operators should:

- **follow proper hitching techniques when using a tractor for pulling objects**
- **use tractors that are fully equipped with an operator restraint system and rollover protective structures (ROPS)**

INTRODUCTION:

On June 9, 1999, a 49-year-old male farmer died when the tractor he was using to pull up a tree overturned on him. The Wisconsin FACE field investigator learned of the incident through the farmer's death certificate. On September 9, 1999, the field investigator visited the site with the sheriff. The FACE investigator also obtained the death certificate and the sheriff's reports. A telephone interview were held with the victim's wife.

The 50 acre cherry orchard property had been owned by the victim's parents for 35 years. About a year before the incident, the victim purchased a bout 40 acres with intentions to clear the dead trees and brush to prepare for forest plantation or other development. He was an environmentalist, and had experience with operating tractors for over 25 years. There was no written safety program to cover activities conducted on the farm. Most safety information was gained by on-the-job training. Additional information was obtained at equipment dealers and farm magazines.

INVESTIGATION:

The victim was clearing an old cherry orchard that was no longer used for commercial purposes, to prepare the property for other uses. He had been working for several months at this activity, previously using a chain saw to cut down trees, and digging out the stumps afterward. The area that he was working in on the afternoon of the incident was across the road from the family's residence, at the end of a farm lane approximately 250 yards from the road. The farmer was using a 1942 Ford 9N tractor that was not fitted with ROPS. It is unknown if the tires were fluid-filled.

He attached a chain to the base of a small cherry tree, and the other end to the base of the operator's seat. The victim was in the operator's seat, and apparently accelerated the tractor to pull on the tree. The tractor flipped over backwards, and the farmer was pinned between the seat and the ground. His wife had been waiting for him to join the family for supper, and went to the field when he failed to return to the house as expected. She found him beneath the tractor, and called for emergency services. The victim was pronounced dead at the scene.

CAUSE OF DEATH: The death certificate listed the cause of death as craniocerebral trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Farm tractor operators should follow recommended hitching techniques when using a tractor for pulling objects.

Discussion: Rear rollovers of tractors are sudden events that may involve improper hitching of a load. A rollover will occur when a tractor's center of gravity shifts beyond the rear stability baseline. An excessive load that is correctly attached to a drawbar set at the recommended height will cause slipping of the rear wheels or stalling of the tractor's engine before a rollover is induced. However, when a load is hitched high on the tractor or attached directly to the rear axle, less power is required to lift the front end of the tractor than to move the load or slip the wheels, which may result in a rollover through rearward rotation. For proper hitching to a tractor, the drawbar on a tractor should not be altered by raising or shortening it, and the load should only be attached directly to the drawbar. Farm tractors are not designed for logging and other non-farming activities; therefore, it is particularly important to observe these prevention strategies during such activities.

Recommendation #2: Farmers should only use tractors that are fully equipped with an operator restraint system and rollover protective structures (ROPS)

Discussion: The tractor in this incident was not equipped with a seatbelt or ROPS when it was manufactured in 1942. A retrofit system for the tractor in this incident is available from equipment dealers for about $500. ROPS should always be used with an operator restraint system to keep the operator within the zone of protection in case of an overturn.

References

A Guide to Agricultural Rollover Protective Structures. 1997, National Farm Medicine Center, Marshfield, WI. Available at www.marshfieldclinic.org/nfmc/rops .

FATAL ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM

FACE INVESTIGATION # 99WI05501

Staff members of the FACE Project of the Wisconsin Division of Health, Bureau of Public Health, do FACE investigations when a work-related fatal machine-related, youth worker or road construction work-zone death is reported. The goal of these investigations 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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FACE INVESTIGATION # 99WI03701

SUBJECT: Farm Worker Dies after Being Struck by a Flywheel of a Haybaler

SUMMARY: An 56-year-old male farm worker (the victim) died after being struck by a flywheel of a PTO-powered haybaler at his son's farm. He was lying on his side under the baler, oiling a chain, while the baler was operating. A flywheel for the bale tosser cycled and struck the victim on the top of his head. The victim's son had been working nearby, and approached the area to ask his father when the baler would be ready for field use. When the victim failed to respond, the son noted the head injury and called for help. EMS responders arrived at the scene within several minutes. The victim was pronounced dead at the scene by the medical examiner.

The FACE investigator concluded that, to prevent similar occurrences, farm equipment operators should:

- **observe and follow all applicable safety precautions when operating machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery to make repairs, adjustments or perform maintenance.**

In addition, farm owners should:

- **include safety management as an integral part of their business operation.**

INTRODUCTION:

On June 26, 1999, an 56-year-old male farm worker died after being struck by a flywheel of a haybaler at his son's farm. The Wisconsin FACE field investigator learned of the incident through the newspaper on June 27, 1999. The investigation was initiated on July 23, 1999, with an interview with the coroner, and followed up with a site visit, limited family interviews, and the sheriff's report.

The victim operated a farm implement dealership, and worked part-time on his son's crop farm. He learned farming through on-the-job training when he operated a family farm. It is unknown how he was trained for farm equipment repair. There was no written safety program for the son's farm operation.

INVESTIGATION:

On the day of the incident, the victim was preparing a PTO-driven haybaler to help his son at the son's farm. The baler was attached to a tractor, parked in the

farmyard, while the victim performed routine oiling and inspection activities. He was using an oil spray can to lubricate the chains on the baler. The equipment design allows this task to be done from above with the machine off, and is performed routinely in this manner at the farm. He had apparently completed oiling from above, and then turned the tractor on and engaged the PTO to operate the baler. Although the event was unwitnessed, it is speculated the victim crawled partway under the baler to oil another location. He was lying on his side under the baler while it was operating. A flywheel for the bale tosser cycled and struck the victim on the top of his head. The victim's son had been working nearby, and approached the area to ask his father when the baler would be ready for field use. When the victim failed to respond, the son noted the head injury and called for help. EMS responders arrived at the scene within several minutes. The victim was pronounced dead at the scene by the medical examiner.

CAUSE OF DEATH: The death certificate listed the cause of death as craniocerebral trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Farm equipment operators should observe and follow all applicable safety precautions when operating machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery to make repairs, adjustments or perform maintenance.

Discussion: The chains on the hay baler in this case could be safely oiled from above while the machine was not operating. After the victim finished oiling it in the recommended manner, he apparently turned on the tractor, engaged the PTO, and went under the baler to oil another location. The incident would have have been prevented if the victim or a standby helper had observed the machine for the location of squeaking parts from a safe distance while it was operating, then disengaged the PTO and turned off the tractor before going under the baler.

Recommendation #2: Farmers should include safety management as an integral part of their business operation.

Discussion: Components of an effective safety management system include a written safety program, hazard analysis and control, training programs and safety committees. Each of these components should be developed to meet the specific needs of individual farms, and be incorporated into the farmers' business operating plan. In this case, the incident might have been prevented if the farm developed and enforced a safety program, including a policy of observing operating machines for maintenance and repair problems from a safe distance.

REFERENCES

Safety Management on the Farm, Mark A. Purschwitz, 1996, Department Bulletin of University of Wisconsin-Madison College of Agricultural and Life Sciences, Madison, WI

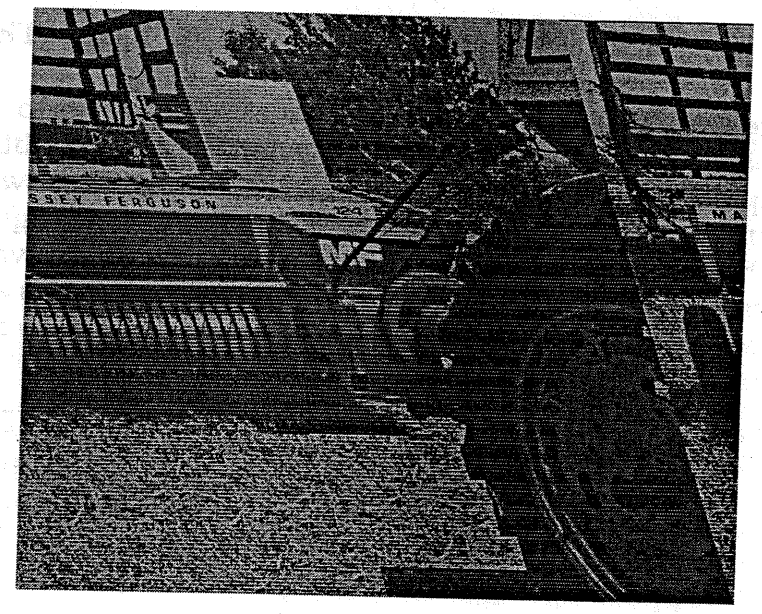

Figure 1. The arrow indicates the victim's location.

FACE INVESTIGATION # 99WI01201

SUBJECT: Farmer Dies After he was Entangled in the Driveline Shaft of a Manure Spreader

SUMMARY: An 24-year-old male farmer (the victim) died after becoming entangled in the unguarded rotating driveline shaft of a manure spreader. The spreader was connected to a tractor equipped with a power take-off (PTO), which powered the spreader driveline. The victim was working alone in the barnyard, replacing a bolt on the shaft. He apparently had completed this task, and was standing on ice-covered soil near the rotating driveline. Then, he either slipped and fell onto the driveline, or his clothing was caught and pulled by protruding parts of the rotating shaft. He was spun around the driveshaft, and portions of his clothing were entangled on the driveshaft and torn from his body. His wife approached the site of the incident when her husband had not returned to the farmhouse as expected, and found him entangled on the driveline. The tractor engine was not running. She called to the victim's brother who was working in the barn, and he freed the victim by cutting the tightly tangled clothes. The brother summoned EMS, while the victim's wife began CPR. EMS responded within several minutes. The coroner's office was contacted, and pronounced the victim dead at the scene. The FACE investigator concluded that, to prevent similar occurrences, farm machine/equipment operators should:

- **observe and follow all applicable safety precautions when operating machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery to make repairs, adjustments or perform maintenance.**

- **identify machinery/equipment components that are PTO driven, and ensure that appropriate guards, recommended by the manufacturer or dealer, are installed.**

- **avoid wearing clothing that is loose-fitting, or has loose ends that could be caught by moving machine parts and lead to entanglement**

INTRODUCTION:

On February 25, 1999, a 24-year-old male farmer died after being entangled in the PTO-drive driveline shaft of a manure spreader. The Wisconsin FACE field investigator learned of the incident through a call from the WI Workers' Compensation Division on February 25, 1999. On September 10, 1999, the field investigator visited the farm and met with the victim's wife. The FACE investigator also obtained the death certificate, the state climatologist's report, and the sheriff's

and coroner's reports.

The farmer and his wife were raised on farms in community settings that depended on horses instead of powered machinery. When the farmer was about sixteen years old, he moved with his family to the farm where the incident occurred. They switched from horse-drawn equipment to gasoline and electric powered machines during this period. He worked with his parents at the site for about six years, then his wife moved to the farm and the couple took over the farm's operation. The farmer's brother lived on the property and assisted with farm chores. They milked about 35 cows, and raised corn and hay for cattle feed.

The victim had also worked for other dairy farmers before he operated his own farm, and for a farm equipment dealer where he learned to repair machinery. He attended classes for crop and soil management, but had not received formal training in farm machine safety. There were no written safety policies or procedures for the farm activities. Usually, the farmer's wife milked the cows and the farmer did other farm chores of feeding and barn cleaning. The farmer also repaired and maintained the farm equipment. He had verbally warned family members about the hazard of contacting the rotating drive shaft of the manure spreader, and would usually walk around the tractor and spreader to avoid contacting the rotating drive shaft. Prior to the incident, there were no fatalities on the farm.

INVESTIGATION:

The farmsite consisted of a dairy barn, storage sheds and grain bins, a famhouse, mobile home, and surrounding crop fields. The barnyard was adjacent to the farmhouse. On the day of the incident, the soil was frozen and covered with snow. There were patches of ice in the barnyard, and the outdoor air temperature was about 23°F. The victim dressed in layers of pants, coveralls, a long loose-fitting insulated coat, and rubber boots. The farmer's wife completed the milking chores and went into the house to prepare for a meeting in town. Meanwhile, the victim unloaded manure using the spreader. The manure spreader was old, and did not have a driveline guard when it was obtained from an unknown source before the victim began operating the farm. He told his wife about a broken piece on the spreader driveline shaft, and his intention to repair the part with a bolt before going to the meeting with her. He drove a PTO-equipped tractor with the spreader to the barnyard, and replaced a broken bolt on the driveline. Apparently, he started the tractor engine and the PTO, and was standing next to the rotating shaft to inspect the operation. He may have been using a shovel to scrape ice from driveline parts before the incident occurred. Then, he either slipped and fell onto the driveline, or his clothing was caught and pulled by protruding parts of the rotating shaft. He was spun around the driveshaft, and portions of his clothing were entangled on the driveshaft and torn from his body. His wife approached the site of the incident when her husband had not returned to the farmhouse as expected, and found him entangled on the driveline. She called to the victim's brother who was working in the barn, and he freed the victim by cutting the tightly tangled clothes. The tractor engine was not running, although the key was turned to the on position. The brother summoned EMS, while the vicitm's wife began CPR. EMS responded within

several minutes. The coroner's office was contacted, and pronounced the victim dead at the scene.

CAUSE OF DEATH: The death certificate listed the cause of death as traumatic asphyxiation.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Farm equipment operators should observe and follow all applicable safety precautions when operating machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery to make repairs, adjustments or perform maintenance.

Discussion: In this case, the farmer apparently turned the tractor engine on and engaged the PTO after replacing the bolt on the spreader driveline. He then dismounted the tractor and was standing next to the rotating, unguarded driveline. He may have done this to inspect the operation of the driveline after his repair task was completed. When it is necessary to view an unguarded, operating driveline, two people should be involved if the tractor must be dismounted from the back (over the PTO). The tractor operator should remain seated, while a standby person is observing the driveline from a distance. The operator should start the PTO slowly, because projectiles may be thrown from the rotating driveline. When using a tractor where the operator dismounts from the front, the operator can leave the seat to observe the driveline from a distance, but should never get close enough to come in contact with the machine.

Recommendation #2: Farm equipment operators should identify machinery/equipment components that are PTO driven, and ensure that appropriate guards, recommended by the manufacturer or dealer, are installed.

Discussion: The manure spreader in this case was very old, and did not have a driveline guard when obtained by the farmer. It is unknown if a replacement or retrofitted guard could have been purchased. If a driveline is too old to accept a guard, farmers should contact the manufacturer or equipment dealer for recommendations on replacement of the driveline with a part that can be guarded.

Recommendation #3: Farm equipment operators should avoid wearing clothing that is loose-fitting, or has loose ends that could be caught by moving machine parts and lead to entanglement.

Discussion: When working around equipment, particularly rotating drive lines, workers should wear well-fitting clothing that is free of drawstrings, tabs and loops, loose threads or flaps of cloth that could be caught by a machine part. The victim in this incident was wearing a long loose-fitting coat. The incident might have been prevented if the victim's clothing was more form fitting without loose parts to be caught in the machine.

FATAL ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM

FACE INVESTIGATION # 99WI01201

Staff members of the FACE Project of the Wisconsin Division of Health, Bureau of Public Health, do FACE investigations when a work-related fatal machine-related, youth worker or road construction work-zone death is reported. The goal of these investigations 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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FACE INVESTIGATION # 99WI03801

SUBJECT: Farm Worker Dies After Tractor Overturns

SUMMARY: An 18-year-old male farm worker (the victim) died after the tractor he was driving overturned and he received crushing injuries from being tossed in the cab. He had been using the tractor attached to a hay rake while raking hay in a field, and was making the last turn in a 12-acre field. The tractor overturned while he was turning around on a hillside with approximately 20° grade. The tractor was equipped with a rollover protection structure (ROPS) and seatbelt, but apparently the victim was not using the seatbelt at the time of the incident. The farm owner discovered the injured victim in the cab of the overturned tractor when he went to the field to deliver sandwiches for an afternoon break. The farm owner went to a nearby house to call for emergency services, which arrived within five minutes. The victim was pronounced dead at the scene by the medical examiner. To prevent future fatalities of this type, the FACE investigator recommends farm tractor owners and operators should:

- **always use an operator restraint system while operating a tractor equipped with rollover protective structures**

- **evaluate the terrain prior to beginning an operation with a tractor, and plan safe strategies for addressing the hazards**

In addition, farmers and other employers with workers assigned to work in isolated situations should:

- **provide personal communication devices to workers assigned to remote worksites.**

INTRODUCTION:

On June 22, 1999, an 18-year-old male farm worker died after being tossed in the cab of a tractor that overturned. The Wisconsin FACE field investigator was notified by the area OSHA office on June 23, 1999. On August 18, 1999, the field investigator visited the site and met with the farm owners. The FACE investigator also obtained the death certificate and the coroner and sheriff's reports. Telephone interviews were held with the victim's parents.

The employer was a dairy farm owned and operated by a family comprised of a couple and their three adult sons. The family had about 350 dairy cattle at two farm sites 3 miles apart, and raised crops for cattle feed at these sites and other fields owned or rented in the vicinity. Portions of the farm had been in the family for four generations. Seasonally, the family hired one or two farm workers to help with field and barn chores. The workers used the farm's equipment, and were expected to follow the safety practices of the farm.

There was no written safety program to cover all activities conducted on the farm. Most safety information was gained by on-the-job training. Additional information was obtained at equipment dealers, farm magazines, and farm organization meetings. The family also used videos and literature from equipment manufacturers to instruct farm workers on safe work practices. Until the incident, there had never been a tractor rollover on the farm, or any serious or fatal injury. The family owned eight tractors, and all were equipped with ROPS. It is unknown how many had seatbelts.

The victim was a high school student on summer break, with intentions to attend the university farm short course after graduation. Although he was not raised on a farm, he had shown interest in farm machines and activities since he was a young child. He belonged to 4-H, and raised sheep and other animals at his family's rural property for show and profit. Prior to being hired by the farm family, he had worked at a neighbor's veal farm baling hay, picking stones and doing other chores. Recognizing his interest in farm machinery, his father bought him an old tractor about three years ago and insisted the victim obtain tractor safety training at that time[1]. The victim had not reported any injuries or near-misses from farm machinery.

The victim was a friend of the farm family, and had been hired at the farm about two months before the incident. He had volunteered at the farm prior to being hired, and was familiar with the family's farm routines and practices. His job duties included helping with the morning milking chores and usually doing field work in the afternoon. Between chores, he often went to the farmhouse for meals and breaks. His workday began around 8 AM each day, and usually ended around 5 PM, depending on the workload. He received on-the-job training, including safe work practices such as wearing a seatbelt while driving a tractor and driving slowly on curves and hills.

[1]Note: Wisconsin requires a one-time certificate of safety training for individuals under age 16 who operate tractors (except on their family's farm).

INVESTIGATION:

The incident occurred at a 12-acre hayfield located about 3 miles from the primary farm site. The hayfield terrain had gently rolling hills, and the field was irregularly shaped due to residential home sites that had been carved out of the larger field area. Weather conditions on the day of the incident were clear, warm and dry. The 17-year-old tractor involved in the incident was purchased new by the family, and had been used regularly since that time. The original four-post ROPS with open cab and seatbelts were in place, and had not been altered. The tractor had air-filled rear tires, and wide-set front wheels. A hay rake was attached to the tractor's PTO and drawbar.

The hayfield was located about three miles from the main farmsite. Terrain in the area was low-grade hills with long runs. New homes bounded the field on most of three sides, with a wooded area on the fourth side. The hay was cut and lying in broad rows that ran up and down the slopes. The victim went to the field about 2:30 PM to rake the hay, and was apparently completing the last turn on the rows when the incident occurred. He was at the top of a hill with approximately 20° grade, and was making a turn. The

incident was unwitnessed, but it appears he applied the brakes on one side of the tractor while allowing the other side to turn freely, which allows the tractor to pivot 180°. It is unknown what his speed was during the turn. The tractor was equipped with a seatbelt, but apparently the victim was not using the seatbelt at the time of the incident. The farm owner discovered the victim lying on his back in the cab of the overturned tractor when he went to the field to deliver sandwiches for an afternoon break. The victim was not moving or making any sounds when he was discovered. The farm owner went to a nearby house to call for emergency services, which arrived within five minutes. The victim was pronounced dead at the scene by the medical examiner. The tractor was in second gear with the engine off, when it was discovered. Subsequent testing of the brakes and transmission found them to be in good working condition.

CAUSE OF DEATH: The death certificate listed the cause of death as crushing chest injuries from a farm tractor accident.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Farm tractor operators should always use an operator restraint system while operating a tractor equipped with rollover protective structures.

Discussion: The tractor in this incident was manufactured with ROPS and a seat belt, and this equipment was in working condition at the time of the incident. Apparently, the seatbelt was not fastened when the tractor overturned, and the victim was tossed from the operator's seat and struck the cab structures. He was discovered lying on his back with his ahead against the top of the tractor, which was turned on its right side. His death might have been prevented if his seatbelt had been fastened. Seat interlock devices allow the tractor to be started only when the operator is seated and the operator is restrained by a seatbelt, safety bar, or other restraining device. Seat interlock devices are available on many late-model tractors.

Recommendation #2: Farm tractor operators should evaluate the terrain prior to beginning an operation with a tractor, and plan safe strategies for addressing the hazards.

Discussion: Hilly terrain may cause tractors to tip over when turning or traversing at a steep angle. Farm tractor operators should evaluate the slope and contours of the fields they will be working, and adjust tractor speed and turning radius to eliminate the tipping hazard. It is unknown what speed the tractor in this incident was traveling at when it tipped. The victim was making a sharp turn before the crest of a hill. The incident might have been prevented if the hay tending rows were planned to avoid sharp turns on hillsides.

Recommendation #3: **Employers should provide personal communication devices to workers assigned to remote worksites.**

Discussion: A reliable system for promptly communicating messages to and from individuals working in remote worksites can provide a safer work environment. Supervisory staff could use radios to locate isolated workers for urgent messages, and the workers could quickly summon assistance if an emergency occurred at their worksite. In this incident, the farm owner would have been able to summon emergency medical services to the site immediately if a portable phone had been available.

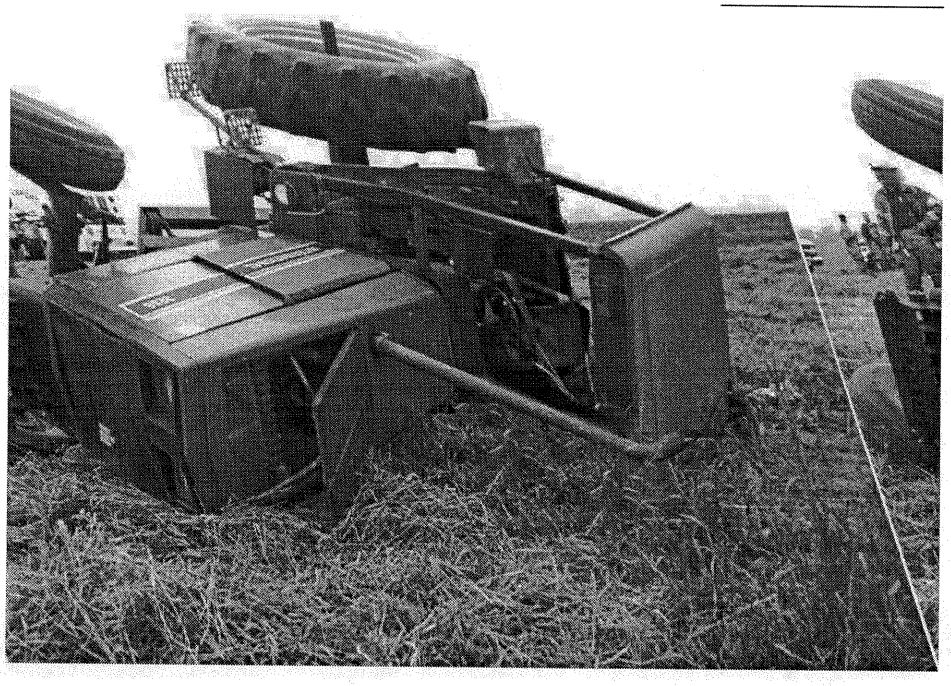

Figure 1. The arrow indicates the victim's location.

FATAL ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM

FACE INVESTIGATION # 99WI03801

Staff members of the FACE Project of the Wisconsin Division of Health, Bureau of Public Health, do FACE investigations when a work-related fatal machine-related, youth worker or road construction work-zone death is reported. The goal of these investigations 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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FACE INVESTIGATION # 95WI09601

SUBJECT: Farmer Dies From Being Entangled in Unguarded PTO Unit on Hay Elevator

SUMMARY:
A 79-year-old male farm worker (the victim) died after becoming entangled in the rotating driveline of a portable hay elevator. The elevator was connected to a tractor equipped with a power take-off (PTO), which powered the chain and sprocket drive of the elevator. Neither the tractor PTO stub shaft, the drive line nor the chain and sprocket were guarded. The victim was working with his son (the farmer) and other family members in the farmyard, loading hay bales into the barn for animal feed. They had completed the loading activities, and the victim was in the process of cleaning and lubricating the elevator chain with an oiled cloth. He was standing next to the operating elevator, with his back to the PTO driveline, when his coat was caught and pulled by the rotating driveline. He was flipped over the driveline, and landed on the ground on the other side of the tractor, tearing his left arm off at the shoulder. A family member heard him yell and looked in the direction where the victim had been working. She saw him lying on the ground, called for help and ran to assist him. The farmer shut off the tractor and applied direct pressure to the wound while the family member called for emergency services. The ground ambulance and helicopter ambulance arrived within twenty minutes, and sheriff's deputies arrived soon after. The victim was transported to a regional trauma center by the air ambulance, where he was pronounced dead on arrival. The FACE investigator concluded that, to prevent similar occurrences, farm machine/equipment operators should:

- **identify rotating or moving machinery/equipment components, such as PTO drivelines, and ensure that appropriate guards are installed**
- **observe and follow all applicable safety precautions when operating machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery**
- **avoid wearing clothing that is loose-fitting, or has portions that could be caught by moving machine parts and lead to entanglement**

In addition, farmers should:

- **include safety management as an integral part of their business operation**

INTRODUCTION:
On September 23, 1995, a 79-year-old male dairy farm worker died after being entangled

in the PTO-driveline of a hay elevator. The Wisconsin FACE field investigator was notified by the Wisconsin Department of Industry, Labor & Human Relations, Workers Compensation Division, on October 23, 1995. On May 29 , 1996, the field investigator visited the farm and met with the victim's wife and son. The FACE investigator also obtained the death certificate, the sheriff's report and the state climatologist's weather report of the day.

The dairy farm in this incident had been purchased by the farmer, his wife and family about ten years prior to the incident. The farmer had limited experience with farm operation prior to that time so his father (the victim) and his mother moved to a mobile home on the farm property to help out with the farm operation. The victim had retired from his job with the post office about 15 years before the incident, then operated a greenhouse with his wife for about four years. He had not received any formal training on operating farm equipment, but learned through on-the-job training provided by his son and neighbors. The farmer's wife and teenage children also performed farm chores, but the farmer had no additional employees. There were no written safety policies or procedures for the farm activities. Prior to the incident, there were no fatalities on the farm.

INVESTIGATION:
The farm property consisted of a farmyard with dairy barn, silos, and feed and equipment storage buildings, with 120 acres of crop and hay fields surrounding the farmyard and farmhouse. The tractor and hay elevator involved in the incident were purchased from a farm neighbor about 10 years prior to the incident and were used each harvesting season since then. The tractor was about 40 years old, and the elevator was manufactured at least 35 years ago. The driveline of the hay elevator was attached to an unguarded PTO stub on the tractor. Sprockets, chains and a driveline were unguarded and exposed on the left side of the elevator. A sprocket was attached to two chains that moved the slatted conveyor bed and hay bales to the top of the elevator when it was in operation. The chains tended to rust, so the farmer or his father oiled them after each use. On this farm, it was usual practice for the victim to oil the chains by squeezing an oil-soaked cloth over the chains while the elevator was operating.

On the day of the incident, the farmer, his wife and parents were moving a load of hay from a wagon in the yard into the barn haymow. They had finished that task by 9:30 A.M., with no apparent problems in the operation of the hay elevator. The air temperature was about 40° F. with no precipitation. At the time of the incident, the victim's wife was in the haymow, while the farmer, his wife, and the victim were working in the vicinity of the conveyor and tractor. The victim was oiling the conveyor chains, while standing at the side of the conveyor with his back turned to the exposed sprockets, drive chains, and the PTO driveline. He was wearing a hip-length jacket with frayed hem and sleeves. His jacket apparently was caught and pulled by the rotating driveline. He was flipped over the driveline, and landed on the ground on the other side of the tractor, tearing his left arm off at the shoulder. The farmer's wife heard him yell and looked in the direction where the victim had been working. She saw him lying on the ground, called for help and ran to assist him. The

farmer, who was a trained EMS responder, applied direct pressure to the wound while the family member called for emergency services. The ground ambulance and helicopter ambulance arrived within twenty minutes, and sheriff's deputies arrived soon after. The victim was transported to a regional trauma center by the air ambulance, where he was pronounced dead on arrival.

CAUSE OF DEATH: The death certificate listed the cause of death as exsanguination due to traumatic amputation of the left arm as a consequence of a farm accident.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Farm machine/equipment operators should identify rotating or moving machinery/equipment components, such as PTO drivelines, and ensure that appropriate guards are installed.

Discussion: In this case, moving sprockets, chains and a driveline were exposed during the equipment"s operation. The 35-year old hay elevator had been purchased without guards from another farmer, and no guards had been installed in the 10 years since the purchase. Unguarded moving belts, sprockets, chains, and rotating drivelines expose workers to entanglement resulting in injuries and even death. If retrofit guards had been installed over the exposed driveline, the incident may have been avoided. To prevent installation of an inadequate guard, machine/equipment owners should consult with the manufacturer or dealer before installing any guard.

Recommendation #2: Farm machine/equipment operators should observe and follow all applicable safety precautions when operating, maintaining or repairing machinery driven by tractor power take-off equipment, including disengaging the PTO and stopping the tractor engine before approaching the machinery.

Discussion: In this incident, the victim was oiling a hay elevator driven by a PTO, and became entangled in the unguarded PTO driveline and died. When working with PTO-driven equipment, the PTO should be disengaged and the tractor engine shut off before approaching the equipment. These precautions provide the operator protection from contact with the moving machine parts and from the unexpected engagement of power when an operator is cleaning, servicing, adjusting, or repairing the equipment. It was customary practice at this farm to oil the conveyor chains by holding an oil-soaked cloth over the chains while they rotated. This task might have been accomplished by disengaging the PTO, oiling the exposed section of chain, then briefly resuming PTO operation to rotate the chain until the next section was exposed for oiling. If the PTO had been disengaged and the tractor engine stopped before the victim approached the conveyor, this fatality would have been prevented.

Recommendation #3: Farm machine/equipment operators should avoid wearing

clothing that is loose-fitting, or has portions that could be caught by moving machine parts and lead to entanglement

Discussion: When working around equipment, particularly rotating drivelines, workers should wear well-fitting clothing that is free of drawstrings, tabs and loops, loose threads or flaps of cloth that could be caught by a machine part. The victim in this incident was wearing a loose-fitting hip-length jacket with frayed hem and sleeves. His jacket apparently was caught and pulled by the rotating driveline. The incident might have been prevented if the victim's clothing did not have loose, frayed edges that could be easily caught in the machine.

Recommendation #4: Farmers should include safety management as an integral part of their business operation.

Discussion: Components of an effective safety management system include a written safety program, hazard analysis and control, training programs and safety committees. Each of these components should be developed to meet the specific needs of individual farms, and be incorporated into the farmers' business operating plan. The financial cost of implementing the program may be considered expensive, but the business investment would prevent many farm fatalities. In this case, the entanglement would have been prevented by using equipment that was properly guarded. Although the practice of purchasing and using older-model equipment without guards may be regarded as acceptable on small family farms, the hazard of entanglement is present and should be avoided.

REFERENCES

Safety Management on the Farm, Mark A. Purschwitz, 1996, Department Bulletin of University of Wisconsin-Madison College of Agricultural and Life Sciences, Madison, WI

FATAL ASSESSMENT AND CONTROL EVALUATION (FACE) PROGRAM

FACE INVESTIGATION # 95WI09601

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Wisconsin Farmer Fatalities 1995 – August, 2001

Date of death	Age	narrative
12/13/94	77	Dairy farmer became entangled in a corn picker/husker.
12/22/94	61	Dairy farmer lacerated his leg on a silo unloader. A thrombosis developed at the site, and the victim died 6 weeks later of acute pulmonary thrombosis.
2/4/95	46	Hog farmer grinding feed and became entangled in the equipment power take-off driveline.
2/15/95	20	Dairy farmer unloading logs from a pulp truck was crushed when a log fell from the truck.
4/14/95	67	Dairy farmer driving a tractor on road was struck from behind by truck
4/26/95	63	Beef/turkey farmer was driving a skid steer loader along fencelines when it rolled over and crushed him.
5/9/95	65	65-year old male dairy farmer was pinned and crushed between a bull and a concrete barn wall.
5/20/95	80	80 year old female farm worker was driving a tractor in a field. She was found run over by the tractor.
5/21/95	12	12-year old farm worker was driving a plow pulled by horses when he lost control and was dragged.
6/7/95	15	15 year old farm worker was driving a tractor and empty chopper wagon on highway. He lost control of tractor and it rolled over on top of hi
7/2/95	32	32-year old beef farmer was operating a frontend loader to feed calves when he was caught between the bucket arm and the loader, and crushed.
7/4/95	77	77-year-old dairy farmer fell from a hay wagon and struck his head on a hay elevator. He died two days later from spinal cord injuries.
8/11/95	28	28-year-old female farm worker was operating a forklift when it slid backward into a drainage canal. She was pinned underwater, under the left front wheel.
9/5/95	63	63-year-old dairy farmer was standing next to his tractor on his farm when it rolled over him.
9/6/95	69	69-year-old male farmer was hooking a farm implement to the tractor when the tractor rolled over him.
9/11/95	26	26-year-old male hog farmer was driving a grain truck on the highway. The brakes failed and he was killed in a crash.
9/13/95	48	48-year-old male dairy farmer fell from a hay wagon and was run over by the hay wagon.
9/23/95	79	79 year old farmer was entangled in tractor PTO driveline shaft of a hay elevator. His arm was severed and he died enroute to the hospital of exsanguination.
9/30/95	22	22-year-old farm worker at a grain storage company was in process of collecting a sample of corn from the dryer when a corn bin collapsed and buried hime. He was outside the bin when the incident occurred.
9/30/95	68	68 year old farmer climbed off tractor to fix a jammed hay baler. He was run over when the tractor rolled downhill.
10/8/95	68	68-year-old male dairy farmer was using a stick to push cob corn into a corn sheller when his hand go caught in the machine. He stepped back to free his and his coat became entangled in the PTO driveline shaft of the sheller and

		he was whirled around the shaft.
10/11/95	71	71 year-old male dairy farmer was standing and riding on the hitch of a filled gravity box wagon as it was being pulled by a tractor. The hitch broke, causing the wagon to roll forward and pin the victim agai nst the tractor.
10/21/95	82	82 year old dairy farmer was operating a corn auger driven by a tractor PTO. His shirt became entangled in the driveline shaft of the corn auger and he was strangled.
11/18/95	23	23 year-old male farm worker was operating a small loader to clear snow from a milking area when he was pinned between the bucket and the loader frame.
12/5/95	71	71 year old male dairy farmer was repairing a corn picker in his barn. The picker was on blocks and when the farmer attempted to raise it with a jack the picker fell and pinned him to the floor.
1/28/96	34	34 year old dairy farmer was engulfed by feed and asphyxiated in a grain bin on his farm.
2/1/96	56	56 year-old male dairy farmer died after being entangled in the PTO unit of a feed grinder.
2/3/96	50	50 year-old male dairy farmer became entangled in a manure spreader on his farm and died of the injuries.
3/19/96	62	62 year old male dairy farmer was kicked in the head by a cow while working in his barn. He died eight months later of the injury.
5/13/96	60	60 year-old male farmer was pinned under plowing equipment when it fell from the hitch.
5/16/96	39	39 year-old dairy farmer was driving a tractor downhill to round up cattle. The tractor overturned, and he was pinned underneath. The tractor was not equipped with ROPS.
5/31/96	61	61 yea-old malw dairy farmer was on a ladder roofing his barn when the rope holding his ladder broke and he fell to a cement floor.
6/3/96	26	26 year-old cattle farmer was working on his family farm when he was electrocuted. He was raising the bed of a dump truck when it contacted 4800 volt transmission lines. He died 10 months later.
7/13/96	71	71 year-old male farmer died of being pinned under a tractor after it rolled over on a hillside.
7/15/96	68	68 year-old dairy farmer was repairing an elevated flatbed farm wagon when it fell and struck him in the chest. He died 10 hours later of cardiac arrest while awaiting leg surgery.
7/22/96	18	18 year-old farm worker was baling hay when he became entangled in the hay baler.
7/31/96	47	47 year-old female farmer was a passenger on a tractor towing a hay wagon on the highway. The tractor bounced when the front-end loader hit the pavement, throwing the farmer to the pavement. She died of head injuries.
7/31/96	33	33 yea-old farm worker died after being caught in the auger of a silo unloader.
7/31/96	58	58 year-old dairy farmer was on a tractor that was stuck in a field. His son attempted to pull the stuck tractor, when it flipped over and pinned the victim underneath.
8/22/96	56	56 year-old part-time dairy farmer lost his footing and fell while climbing a silo on his farm.
9/5/96	59	59 year-old dairy and beef farmer died after being trampled in a field by his cows.
9/22/96	79	79 year-old farmer was using a 6-wheel all-terrain vehicle to travel in his farm field when he struck his head on a tree limb and died of head injuries.
10/23/96	15	15 year-old farm worker was loading feed into a total mixed-ration machine when his coat became entangled and

		he was pulled into the mach
11/14/96	55	55 year-old dairy farm worker was attacked and mauled by a bull in the farmyard. He crawled out of the yard and was found by the farm owner. He died of head injuries.
11/28/96	16	16 year-old farm worker was driving a tractor along a road while his father followed on a second tractor. The son's tractor overturned and pinned him.
12/2/96	55	55 year-old dairy farmer was unloading corn from a gravity box into a PTO-driven elevator. Hisclothing became entangled in the PTO driveline and he was strangled.
12/3/96	62	62 year-old diry farmer was operating his tractor when it overturned and he was crushed. He died 4 days later of head trauma.
12/28/96	34	35 year-old dairy farmer was repairing an auger when his clothes becam e entangled and he was pulled into the machine. He died at the scene of the incident.
2/28/97	56	This 51 year old farmer was pinned beneath a rear tractor tire and in between a mounted hay fork while working in his farm yard.
3/3/97	74	This 74 year old dairy farmer fell from the haymow in a barn and hit his head when he fell.
3/14/97	32	This 32 year old tree farm laborer was loading the hopper of a mixer from a silo via a conveyer. It appeared the conveyor may have gotten plugged. Leaving the mixer unit running the victim climbed up to unplug the conveyer and fell to his death into the hopper.
3/17/97	57	This 57 year old farm owner was in the barn pulling down bedding. A large pile of bedding collapsed upon him (straw, hay, soybean). Thirty minutes later he was found dead of asphyxiation.
3/18/97	66	This 66 year old dairy farmer fell from a hay loft striking the back of his head. He died several days later from an intra cranial bleed.
3/25/97	57	This 57 year old was up on a pole that held tobacco leaves in his tobacco-drying barn. He slipped an fell about 20 feet to a dirt floor. He had coronary artery disease. Three hours later, in the hospital, he died from cardiac arrest.
4/21/97	47	This 47 year old woman was driving a tractor at the farm where she lived. The tractor overturned backwards while attempting to pull another tractor stuck in the mud. Her chest was pinned by the steering wheel of the overturned tractor.
4/22/97	73	This 73 year old dairy farm owner fell approximately 10-12 feet from a hay loft onto a haywagon. He died 10 days later from an epidural hematoma.
6/4/97	63	This 63 year old farmer was attempting to bring a 1500 pound bull inside. In the process the bull turned on him knocking him down and going after him. A nephew pulled the victim away. He died shortly after being taken to the hospital.
6/10/97	50	A 50 year old farmer driving his tractor entered a creek. The tractor slid and overturned pinning the victim. He had been seen about 9:00 a.m. that morning and was found about 1:00 p.m. that afternoon. He was pronounced dead at the scene.
7/3/97	22	22 year-old farm worker died after being caught in the beater of a hay chopper box at the farm where he was

		employed.
7/5/97	54	Decedent, a 54 year old male, was mauled and trampled by a bull while working in his barnyard.
7/12/97	76	This 76 year old man fell in the hog yard and was rolled around by the hogs. He was unable to move. He died eight days later in a hospital from respiratory failure.
7/12/97	32	This 32 year old male was stacking round hay bales with a tractor. The tractor rolled over pinning the victim underneath.
8/30/97	37	This 37 year old male farmer was working on the inside of a fifty foot oxygen-depleting silo. He fell to the base and died of fall injuries.
9/9/97	51	A combine collapsed on this 51 year old farmer.
9/11/97	28	A 28 y0 male farmer lost control of his tractor while pulling 2 empty hay wagons. He was pinned under the tractor and died at the scene.
10/5/97	39	This 39 yo male farmer fell 50 feet down the inside of the enclosed silo chute. The chute was located on the outside of the silo.
10/8/97	36	A 36 year old male killed by a bull.
10/20/97	34	This 34 year old farmer was working alone unloading corn at the base of a silo. His clothing got caught in a moving auger. He was decapitated and his left arm amputated.
10/23/97	74	74 year-old farmer male dairy farmer was pulled into a grain auger when his pant leg was caught by the auger.
10/25/97	35	35 year-old farm worker died of head injuries he suffered 3 months earlier when he fell into a large barn fan.
11/3/97	39	39 year old male farmer was repairing the inside of a grain bin filled with 14,000 bushels of shelled corn. He fell into the corn and was suffocated.
11/15/97	30	30 year old male farmer died of crushing chest injuries when he drove his tractor out of a wet ditch and it flipped backwards on him.
12/9/97	62	62 year-old male dairy farmer was found by a neighbor, pinned under an overturned tractor. He died the following day of injuries.
12/18/97	70	70 year old male farmer was crushed between the bucket and frame of a skidsteer loader at his farm.
1/3/98	36	36 year old farm worker died after his coat sleeve was caught in a PTO driveline and he was pulled into the farm equipment at his brother's farm.
1/4/98	14	14 year old farm worker died when he lost control of the tractor he was driving on icy roads. The tractor went down a 6 ft ditch and the victim was pinned underneath.
3/26/98	75	A 75 year old male dairy farmer suffered massive traumatic injuries from being entangled in a barn cleaner.
4/2/98	51	A 51 year old male livestock farmer fell from an endloader, accidentally causing the machine to engage, which in turn caused the bucket to fall on the victim. Massive crushing injuries resulted in the death of the victim within the hour of the injuries.
6/5/98	79	A 79 year old farmer was driving his tractor to dam a spring for his cattle when the tractor overturned and he was pinned beneath.

6/24/98	43	A 43 year old female farmer was driving a tractor to cut hay on her farm when she was thrown from the tractor and was run over by it. She also worked part time as a nurse.
7/1/98	65	65 year-old male dairy farmer died of suffocation in a grain bin fille with corn. The victim fell or was drawn in from an internal silo ladder.
7/5/98	5	A 5 year-old male farm worker on his family's farm was riding on the front bucket of a skidloader being driven by his brother. The victim was on his way to complete a regular chore of feeding the farm horses, which are used for field work. The skidloader his a bump, and the victim was tossed out and run over.
7/22/98	14	A 15 year-old male farm worker on a dairy farm was driving a tractor through a field when the tractor hit a stump hidden in tall grass. The tractor rolled over on its back and pinned the victim under it.
8/6/98	14	14 year-old farm worker at a produce farm died when he was pinned under the wheels of a small farm tractor while he was mowing grass.
9/3/98	63	63 year-old male part-time dairy farmer was operating a tractor on a roadway when it overturned into a ditch. He was thrown from the tracto and pinned beneath it.
9/6/98	52	52 year-old female farmer was trampled by a cow at her family farm. A fractured ankle was repaired by surgery, and the victim died 32 days later of a pulmonary embolism.
9/8/98	80	80 year-old male dairy farmer was trampled to death by cattle in the farmyard.
9/9/98	82	82 year-old farmer was repairing his farm tractor motor while using a wrench to jump-start the motor. The tractor lurched forward and ran over the victim.
9/10/98	65	65 year-old male dairy farmer died after he was pinned under a tractor when it rolled over on a hillside. He was hauling a large hay bale in the front end loader at the time of the incident.
9/20/98	16	16 year-old farm worker on his family's dairy farm entered a silo that was half-full of fresh-chopped corn silage. He was overcome by silo gas and could not be resuscitated by rescue workers.
10/12/98	41	41 year old male farmer was working at his brother's dairy farm when his sweatshirt sleeve got caught on a revolving shaft. He was pulled into a corn harvesting machine.
10/17/98	30	30 year-old dairy farmer was manually moving a corn elevator on his farm when it contacted 7200 volt overhead powerlines and he was electrocuted.
10/26/98	73	73 year-old male dairy farmer was dismounting a skidsteer loader at his farm when he bumped the bucket lever. The bucket came down and crushed hime between the cab and tire.
11/2/98	48	46 year old-male dairy farmer was buried in a trench he was digging for a water line. He had climbed off the construction equipment he was using to dig, and went into the trench where his son was working. The trench collapsesd and buried both men, but a chunk of clay soil wedged and protected the son.
12/8/98	56	Dairy farmer was standing next to the tractor he was repairing. He started the tractor, which lurched forward and ran over his legs.
2/15/99	39	39 year-old dairy farmer became entangled in material caught in the wheels of a skid steer loader. He was moving hay from a plastic covered large bale when the plastic became entangled and he reached outside the cab to

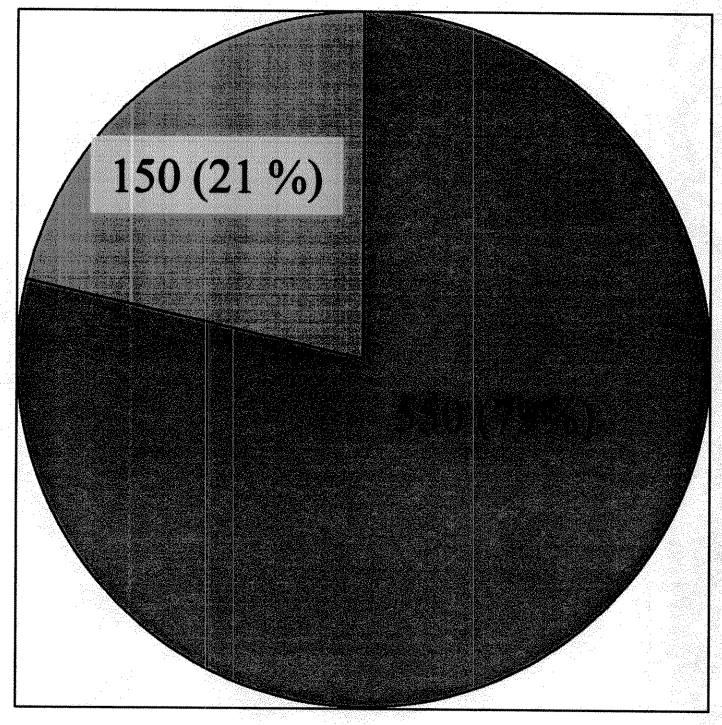
		attempt removal.
2/25/99	24	24 year-old male dairy farmer was caught in the unguarded PTO shaft on a manure spreader. His jacket was entangled in the machine.
4/8/99	92	92 year old male dairy farmer was pinned under his tractor after it rolled over while he was driving near an embankment. He died 2 weeks later.
6/9/99	49	49 year old male cherry farmer was pulling up a tree with a tractor when the tractor overturned on the decedent.
6/17/99	63	63 year old male dairy farmer was jump starting his tractor. The victim was standing in front of the wheel, and the tractor was in gear. The victim was run over when the tractor lurched forward.
6/18/99	15	15 year old male farm worker was driving a tractor from one field to another across a county road. He pulled out in front of a logging truck, which struck him.
6/20/99	57	57 year old male dairy farmer was electrocuted while repairing a pump outside his barn. He was trying to locate the source of stray voltage that was affecting his herds milk producers.
6/22/99	18	18 year old farm worker at a dairy farm was found dead inside the operating cab of an overturned tractor in a hayfield. The seatbelt had not been used. The victim had been making a turn with the tractor while haying.
6/24/99	51	51 year old male farmer was changing the oil on a tractor when the tractor moved and ran over his chest. The ignition was turned on, but the tractor was not running when the victim was discovered.
6/25/99	67	67 year old male farmer was driving a tractor. When he attempted a steep incline, the tractor slid backwards and partially overturned.
6/26/99	56	56 year old male was struck by a plunger/flywheel of a hay baler at his sons farm.
7/13/99	32	32 year old male died after dismounting one tractor and was trying to board a second tractor when he became caught and was pulled under the wheel.
7/29/99	55	55 year old male farmer was trying to loosen a hydraulic motor on a feed mixer with the assistance of a farm hand. After the bolts had been removed, the motor was relieved and began to move, pinning the victims head.
7/30/99	50	50 year old male farmer was electrocuted while welding a hay binder.
8/19/99	51	51 year old male was helping family members bale hay. As he was driving on an incline, the tractor rolled over and killed the victim.
9/18/99	57	A 57 year old male dairy farmer was operating a tractor pulling a hay baler. He was pulling out of the farm driveway when the front wheel of the tractor struck a hidden concrete culvert. He was thrown from the tractor and run over by the hay baler.
9/25/99	57	57 year old male dairy farmer was underneath a bobcat on the right side making repairs when the jack slipped and the bobcat fell on him.
10/20/99	47	47 year old male farmer was riding his tractor and may have hit a fungal pothole with his tractor. He inhaled fungal allergens causing an acute allergic reaction.
10/23/99	23	The victim was a 24 year old male farmer. No further information is known.
1/13/00	16	16 year old male youth farm worker was using a manure spreader on a hillside when the spreader overturned and he

		was pinned underneath.
1/26/00	60	60 year old male farm worker was asphyxiated when animal bedding collapsed around him while he shoveled.
4/25/00	47	47 year old male farmer was hauling a round bale with his tractor. He had apparently exited the tractor for a moment when it began to roll down a steep embankment. When he caught up with the tractor, it was on an incline and rolled onto him.
4/27/00	72	72 year old male was pinned beneath a stone picker. He got off the tractor to clear a jam in the reel of the machine and was pinned by the reel when it resumed revolution after becoming unjammed.
5/4/00	87	87 year old male farmer was pinned bewteen the bucket and frame of a skidloader after the bucket lowered. The victim had been using the skidloader to haul rocks on his farm field. He exited the loader and when he re-entered, he left the bucket in the raised position and accidentally triggered the lever that released the bucket, which was full of rocks.
5/4/00	68	68 year old male dairy farmer fell off his tractor and was run over by it.
5/8/00	50	50 year old male dairy farmer was driving a utility vehicle while repairing fences when the vehicle overturned and trapped him underneath.
5/8/00	63	63 year old male dairy farmer was standing on the front wheel of a tractor while fueling the tractor in a crop field. The tractor operator thought the victim had jumped down from the wheel, so he started up the tractor and began to back up. The victim fell from the wheel and was run over.
5/20/00	57	57 year old male dairy farmer was repairing a mechanical cattle gate at his farm when he became trapped between the gate and the barn wall.
5/22/00	68	68 year old male farmer was herding cows into a trailer when he was struck in the head by a cow.
5/24/00	50	50 year old male dairy farmer was using a tractor to load manure into a manure spreader. While he was backing up, the left rear tire began riding up a partition wall. This, along with a flat front right tire, caused the tractor to overturn.
6/13/00	50	50 year old male dairy farmer was struck from behind and trampled by a bull.
6/23/00	47	47 year old male farmer was driving a tractor on a hillside when the tractor overturned and pinned him. The bucket on the tractor was filled with dirt that was unevenly distributed.
9/2/00	90	Farmer was refueling a tractor with the motor running when he slipped off a ladder, knocking the tractor into gear. The tractor surged forward and pinned him under the drawbar.
9/23/00	10	10 year old male farm worker was operating a tractor with a chopper box attached. He left the tractor running and stepped up on the platform of a chopper box. He was either pulled in by loose clothing or slipped and fell in the box. The victims father and a hired hand were working nearby and found the victim in the box with the beaters running.
10/3/00	50	49 year old male was trying to realign a tire under the conveyor belt of a hay elevator when the elevator collapsed on the victim.
11/13/00	63	Dairy farmer was attacked by a bull in a pen on the farm. The bull stepped on the victim's head and chest. The victim was able to escape by crawling into the next pen, where he collapsed and died.

11/24/00	50	Farmer was engulfed and smothered in corn while removing chaff from the top layer of corn in a bunker.
12/4/00	69	Dairy farmer was attcked and trampled to death by a bull
12/8/00	77	Farmer fell 4 feet from a combine onto a gravel driveway. He struck his head and became confused, so his son transported him to a local hospital. He was transferred to a regional medical center where he died six weeks later.
12/17/00	49	Part-time farmer was repairing a starter motor on his tractor when the tractor lurched forward and he was pinned under the tractor wheel.
1/18/01	83	Dairy farmer was run over by a tractor.
2/10/01	71	Dairy farmer slipped and fell on ice, striking his head on concrete while herding cattle into the barn.
3/4/01	37	Farm worker hanged himself in the haymow.
3/7/01	33	Dairy farmer was repairing equipment in an enclosed shop when he was overcome by carbon monoxide.
4/18/01	57	Farmer was changing a tractor tire when the rim exploded and struck his face and chest.
4/19/01	53	Farmer was using a skid loader to unload hay bales from a trailer. The drive train of the loader broke, so he stood up from the operator's seat to look at it. His leg hit the handle to lower the bucket, which pinned him against the frame.
4/24/01	63	Dairy farmer was a passenger on the back of a tractor when he lost his balance and fell off. He hit his head on the pavement.
5/11/01	28	Dairy farm worker was pinned against a pole in a milking parlor by a hydraulic gate used to herd cattle.
5/19/01	43	Dairy farmer fell from the top of his farm silo to the ground.
6/5/01	78	Dairy farmer slipped while getting onto his tractor, and was run over by the tractor's rear wheel.
7/12/01	29	Dairy farmer was attacked by a bull while he was trying to corral it to sell at an auction that day.
7/15/01	80	Dairy farmer was thrown to the ground by a rear tractor tire while attempting to climb onto a rolling tractor. He died of head injuries. The incident occurred at a neighbor's farm.

Source: Wisconsin Fatality Assessment & Control Evaluation (FACE) Program
DHFS/ Divison of Public Health, Bureau of Occupational Health
9/6/2001

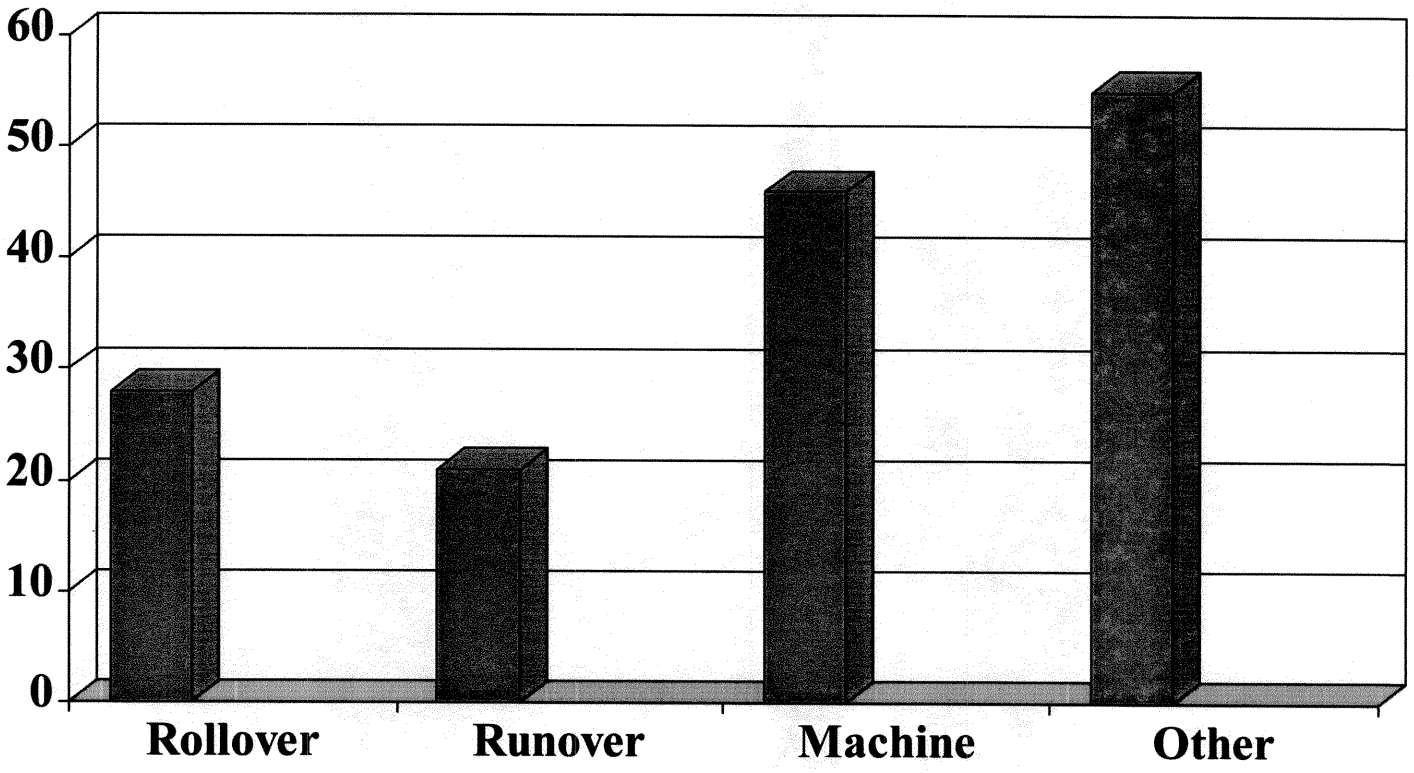
WI Farmer Fatalities
1995 - 2001



Total Work Fatalities = 700

FACE Program, WI DHFS

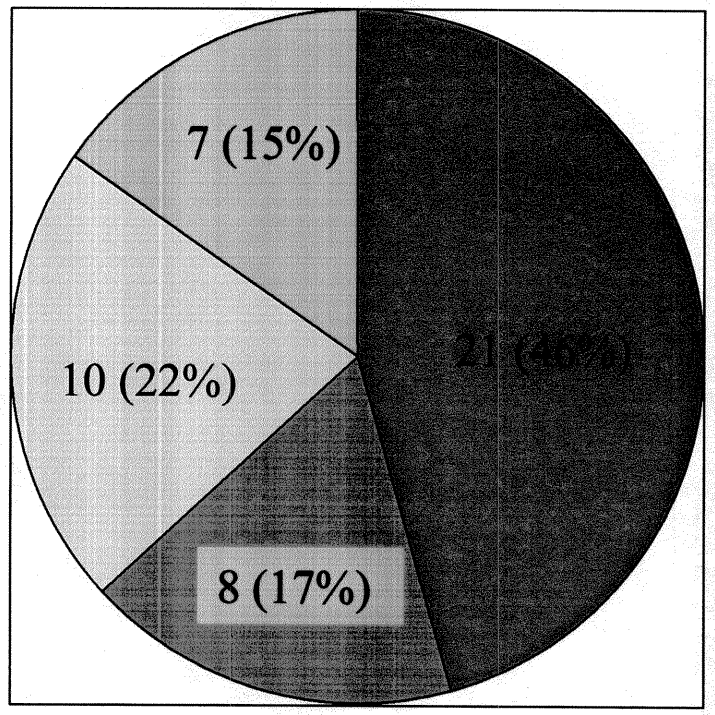
Cause of Fatal Injury to 150 WI Farmers, 1995 - 2001



FACE Program, WI DHFS

46 Fatal Farm Machine Events

1995 - 2001



FACE Program, WI DHFS

MARSHFIELD CLINIC®

FACTS

Origins

Founded in 1916 by six Marshfield physicians.

Professionals

Physician specialists number in excess of 600. More than 300 physicians currently serve at the 39 sites in Marshfield Clinic's regional system. The Clinic employs nearly 4,700 support personnel.

Patients

There were 1,605,106 patient encounters in 2000.

Specialties

Physicians and other medical professionals in more than 80 specialties and subspecialties are available to patients. Examples of specialties include neuro-oncology, maternal-fetal medicine, pediatric orthopaedic surgery and electrophysiology.

Marshfield Clinic System of Care

Since the mid 1970s, the Clinic has established 39 centers in central, northern, eastern and western Wisconsin. Facilities include those in Athens, Bruce, Cadott, Chetek, Chippewa Falls, Colby, Cornell, Eau Claire, Greenwood, Hayward, Ladysmith, Loyal, Marathon, Marshfield, Menomonee, Mercer, Merrill, Minocqua, Mosinee, Park Falls, Phillips, Radisson, Rhinelander, Rice Lake, Schofield, Spooner, Stevens Point, Stratford, Thorp, Wausau, Wisconsin Rapids and Wittenberg.

Research

More than 750 active research protocols/projects are underway at *Marshfield Medical Research Foundation* (MMRF). Included are projects focused on cancer etiology, respiratory disease etiology, the effect of population screening and outreach on disease patterns, animal to human disease transmission patterns, protozoa and human disease, risk factors for disease and injury, the genetic origins for diabetes, epilepsy, childhood metabolic disease, Tourette's syndrome, prostate cancer, patterns of disease and injury in aging populations. Founded by Clinic physicians in 1959, MMRF has grown into one of the largest private medical research facilities in the nation. Housed in the Ben R. Lawton Center and the Melvin R. Laird Center, MMRF also co-sponsors several physician residency training and fellowship programs.

Agricultural Health

The *National Farm Medicine Center* (NFMC) was established in 1981, to conduct high quality research addressing human health and safety associated with agricultural work and rural life. NFMC is composed of four units:

- **National Children's Center for Rural and Agricultural health and Safety:** Scientists are conducting long-term studies to evaluate methods to improve children's safety in rural and agricultural settings. The Center provides technical assistance to professionals involved in injury prevention interventions addressing rural recreational activities and rural youth violence issues.
- **Midwest Agricultural Research Center:** Funded by the National Institute for Occupational Safety and health, this is one of nine regional centers addressing research, interventions and education of region specific agricultural health and safety issues.
- **Environmental Health Laboratory:** Researchers study the effect of environmental factors on human diseases, with emphasis on pathogen virulence and infectious disease.
- **Reproductive Toxicology Laboratory:** Researchers are testing methods for screening developmental toxicants and determining the effects of agricultural exposures on reproductive health.

Outreach Network

More than 1,200 hospitals, clinics and other sites participate in a variety of Clinic outreach programs. Clinic physicians and staff provide off-site consultations in 52 specialties, including allergy, cardiology, family practice, genetics, gastroenterology, internal medicine, nephrology, neurology, neurosurgery, nutrition services, obstetrics and gynecology, oncology, ophthalmology, orthopaedics, otolaryngology, OT/PT, pediatrics, pulmonary medicine, psychiatry, rheumatology, urology, speech pathology and surgery.

Marshfield Laboratories

Over 17 million tests are performed annually. The laboratory, which employs more than 350 people, serves clients across the nation. It has established separate service lines for forensic toxicology, veterinary medicine and food safety.

Security Health Plan of Wisconsin, Inc.

The only HMO owned by Marshfield Clinic, *Security Health Plan* provides coverage of health care services to more than 120,000 members in a 27-county area of Wisconsin. Established in 1986 as an outgrowth of Greater Marshfield Community Health Plan, Security Health Plan offers a variety of insurance options including employer group products, individual direct pay policies, third party administration for self-funded groups, Medicare supplemental insurance, and BadgerCare/Medicaid Managed Care.

Budget

The Clinic's annual operation budget is $498 million.

Corporate Structure

Physicians with 2 years of Marshfield Clinic experience are eligible for the Board of Directors. As Board members, the doctors vote annually for all Clinic officers and other members of the Executive Committee. The Board meets monthly to review the actions of the Executive Committee, make major decisions and establish policy.

http://www.marshfieldclinic.org

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MARSHFIELD MEDICAL RESEARCH FOUNDATION

Fact Sheet

Founded in 1959 by Marshfield Clinic physicians, Marshfield Medical Research Foundation (MMRF) is the largest private medical research facility in Wisconsin and one of the largest in America. MMRF is the Research and Education Division of the Marshfield Clinic system, Wisconsin's most complete health care network. Other components of the network include approximately 550 physician specialists in 38 locations throughout central, northern and western Wisconsin; a multi-state reference laboratory; wholly-owned prepaid health plans and comprehensive residency and continuing medical education programs.

Specific areas of research interest include:
Agricultural Medicine and Health: The *National Farm Medicine Center* was founded in 1981 to provide research, education and community service programs promoting the health and safety of rural Americans engaged in agricultural employment.

Rural Health Services: The *Wisconsin Rural Health Research Center* was established in 1988 to study rural access to medical care and to evaluate health care policy recommendations and alternatives.

The Epidemiology of Disease, Injury and Premature Death Within Rural Populations: The *Marshfield Epidemiology Research Center* undertakes studies designed to identify causes of disease and to help develop and evaluate preventive and therapeutic measures. The *Marshfield Epidemiologic Study Area (MESA)* provides an opportunity to efficiently study the full clinical spectrum of disease, injury or premature death in a general population, since the majority of patients in a large area receive their care through the Marshfield Clinic system and affiliated hospitals.

The Genetic, Immunologic and Environmental Causes of Disease: MMRF operates research laboratories devoted to genetic, protein chemistry, and environmental research, each headed by a Ph.D. scientist and staffed by post doctoral fellows, research associates, and assistants. The laboratories are:

- *Biochemistry Laboratory:* Studying a protein in the blood that is a major cause of high blood pressure.
- *Center for Medical Genetics:* Founded in 1992, it includes six laboratories:
  - *Molecular Genetics Laboratory:* Studying the human genetic map and variable structural forms of human DNA to find the genes responsible for a variety of inherited human diseases (comprised of three laboratories).
  - *Cancer Molecular Genetics Laboratory:* Exploring the genetic causes of cancer.
  - *Molecular and Cellular Biology Laboratory:* Studying a variety of genes associated with inherited metabolic disorders.
  - *Neuro Genetics/Neuro Pharmacology Laboratory:* Studying the genes and other physiological and neurological markers associated with both human and marine epilepsy.
- *Environmental Health Laboratory:* Established in 1994 as a part of the National Farm Medicine Center, this laboratory is studying bacterial and other disease organisms present in surface soils and groundwater, other disease-related organisms in soil and air, and the effect of environmental exposures upon reproductive health.
- *The Clinical Research Department:* Provides support services to clinicians within the Marshfield Clinic system who wish to conduct clinical research funded by internal and external sources (including pharmaceutical sponsored studies, medical device studies and government sponsored studies). The department is composed of biostatistics, clinical trials management, marketing, and clinical specimen processing. The biostatistics area has dedicated trained staff including biostatisticians, clinical research coordinators, statistical assistants and data entry clerks. The clinical studies management area has a dedicated staff including clinical research nurses and clinical research coordinators. Dedicated laboratory and marketing capabilities are also housed within the department.

The Department of Medical Education is housed within the Marshfield Medical Research Foundation. It designs and coordinates formal education programs for health personnel both within the Marshfield Clinic system and other rural areas of North America. Since 1974, post-graduate medical training programs have been offered in internal medicine, pediatrics, general surgery, and dermatology. A transitional year residency also is available to prepare physicians who plan to enter such specialized areas of medicine as anesthesiology or dermatology. Two fellowship programs, dermatologic surgery and geriatrics, offer physicians additional subspecialty training following completion of their residencies.

Current projects: The following represent a few of the more than 200 research projects and 600 clinical trials underway at the Marshfield Medical Research Foundation: cancer etiology, respiratory disease etiology, the effect of population screening and outreach on disease patterns, animal to human disease transmission patterns, protozoa and human disease, risk factors for disease and injury, the genetic origins for diabetes, epilepsy, childhood metabolic disease, Tourette's Syndrome, prostate cancer, patterns of disease and injury in aging populations, and studies of drug and medical device efficacy.

September 1998

National Children's Center
for Rural and Agricultural Health and Safety

Fact Sheet

Childhood Agricultural Injuries

Population at risk

Number of farms	▪ According to the National Agricultural Statistics Service, there were a total of over 2.19 million farms in the United States in 1999.[1]
Number of children	▪ In 1998, there were an estimated 1,264,000 youth who lived on farms under 20 years of age and nearly 60% of these youth also worked on the farm.[2]
	▪ An additional 666,500 youth who did not live on farms were directly hired to work on farms.[2]
	▪ National Agricultural Worker's Survey data estimates that, on average, about 128,000 14- to 17-year-old migrant/seasonal farmworkers were working in crop production from 1993-1996. These youth make up about 7% of all hired migrant/seasonal farmworkers working on crops.[3,4]
	▪ About 6% of all farmworker dependents travel with their families and work alongside their parents. Another 18% of teens 14-17 years in crop production are children of farmers who are hired by farmers other than their parents. The largest group of teen farmworkers, 47%, are economically independent (emancipated minors).[3]

Toll of childhood agricultural injuries

Fatalities	▪ An estimated 104 children younger than 20 years of age die of agricultural injuries on U.S. farms and ranches annually.[5]
Injuries	▪ Approximately 32,800 agricultural related injuries occurred to children or adolescents under the age of 20 who lived on, worked on, or visited a farm operation in 1998.[2]
Rate	▪ The rate of work-related agricultural fatalities for youth age 15-19 years is 12.2 per 100,000 FTE*. This is comparable to those of adults working in agriculture, 20-54 years old.[6]
	▪ National comparisons of fatality rates for agriculture among young workers range from 12 to 16 per 100,000 workers, about three times the national private sector rates of 4.4 to 5 per 100,000.[7]

Characteristics of Injured Children

Gender	▪ Injuries to males account for 86% of all agricultural-related youth injuries with a rate of 2.4 per 100 FTE*. Females experience rates of 1.5 per 100 FTE*.[8]
Production type	▪ Crop production accounts for 52% of all work related fatalities to children whereas livestock production accounts for 31%.[6]
	▪ Of fatalities occurring to males, 53% occur in crop production. Fatalities to females occur primarily in livestock production.[6]
Location	▪ In the Midwest, South, and West, the highest rates of fatal injury to children occur in crop production (35, 16.2, and 15.1 per 100,000 FTE* respectively). In the Northeast, the highest rates of fatalities occur in livestock production (a rate of 13.2 per 100,000 FTE).[6]
Age	▪ Nearly 40% of deaths among males are between the ages of 15-19. Approximately 40% of the deaths among females are between the ages of 0-4.[9]
	▪ Youth 10-15 years of age experience the highest percentage of injury (39%) followed by children less than 10 years (34%) and children 16-19 years (27%).[2]

U.S. Department of Health & Human Services
Public Health Service
HRSA
Health Resources & Services Administration
Maternal & Child Health Bureau

The National Children's Center for Rural and Agricultural Health and Safety (a program of the National Farm Medicine Center, Marshfield Clinic, Marshfield, Wisconsin) is funded by the National Institute for Occupational Safety and Health (NIOSH Award No. U05/CCU514436) and the federal Maternal and Child Health Bureau (HRSA Contract No. 240-98-0005).

Health and Safety

Work status	▪ As many as 56% of agricultural injuries occurring to children are non-work related.[2]
	▪ Of children less than 16 years of age, 64% of work-related fatalities occur to children working on family-owned farms.[6]
Ethnicity	▪ Analysis of injuries to youth 10-19 years of age reveals that 98.7% are white (non-Hispanic) and 1.3% are American Indian.[10]
	▪ Whites (non-Hispanic) are victims of 83.2% of ag-related fatalities. Almost 60% of fatal injuries to Hispanic youth occur during crop production.[6]
Nature of injury	▪ The most common non-fatal types of injuries include contusions/abrasions (24%) and lacerations (23.3%).[8]
	▪ The most common injury resulting in death is to the head or brain, accounting for nearly two-thirds of the total.[5]

Source of Agricultural Injury

Source of death	▪ Farm machinery (including tractors) is the leading cause of fatality, accounting for 36% of deaths to youth less than 20 years of age. Thirty percent of farm machinery-related deaths are among children less than 5 years of age. Machinery is the leading cause of farm deaths in 29 states.[9]
	▪ Drowning is the second leading cause of death on farms (27%) with children less than 5 years of age, accounting for 32% of the deaths.[10]
Source of injury	▪ Machinery (except tractors) accounts for 24.2% of the occupational injuries among farm workers 10-19 years as compared with 19.3% of the injuries to farm workers in all age groups.[10]
	▪ Other common injury occurrences include contact with objects/equipment (struck by falling object, struck by slipping object, caught in or between equipment), 55.4% and falls (lower or same level), 14.7%.[8]

* FTE = full time equivalent

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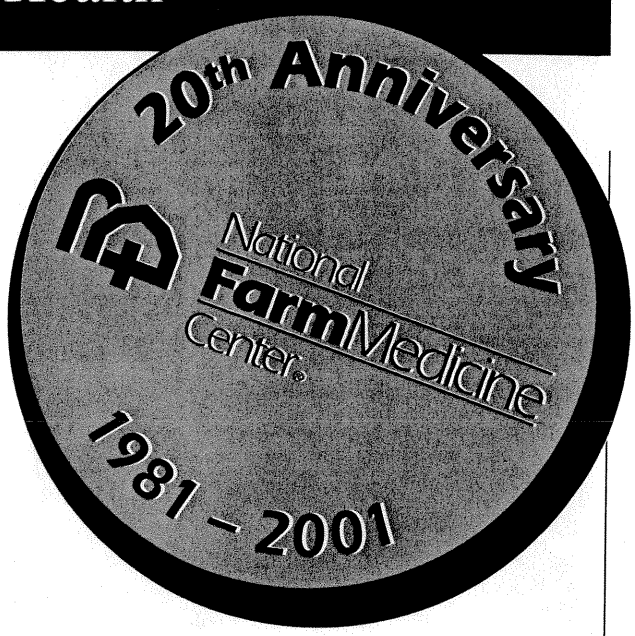
THE NATIONAL FARM MEDICINE CENTER

Leadership in Agricultural Health



Marshfield Clinic has served the farming community since 1916, when six physicians established a group practice in the heart of Wisconsin.

With more than 650 physicians now on staff, Marshfield Clinic is one of the largest group practices in the nation, and still serves a predominantly rural area.

Recognizing that farmers deal with unique occupational disease and injury problems, the Clinic established the National Farm Medicine Center (NFMC) in 1981 as a program of the not-for-profit Marshfield Medical Research Foundation.

Although the countryside is beautiful, an American Medical News editorial concluded that "some of this nation's most disturbing health problems arise where the air is freshest."

The NFMC has focused on the study, treatment and prevention of diseases and injuries that affect farmers and their families. Studies have included repetitive motion injuries, respiratory health, hearing loss, cancer, reproductive health, child safety and infectious diseases.

Children's safety

"We have positioned ourselves as a national leader on children's safety in agriculture," said Barbara Lee, Ph.D., director of the NFMC since 2000.

In 1999, the North American Guidelines for Children's Agricultural Tasks (NAGCAT) were introduced by the National Children's Center for Rural and Agricultural Health and Safety, a federally-funded center within the NFMC. The guidelines are designed to assist parents in assigning farm jobs to children. They are unique in that they are based on individual child development and not ages.

NAGCAT was developed through a consensus process involving farmers, ranchers, physicians, researchers, parents and others interested in childhood safety in agriculture. Research regarding NAGCAT's impact is being conducted by Barbara Marlenga, Ph.D.

The NFMC took a leadership role in children's safety in 1992 when it

organized and sponsored a Childhood Agricultural Injury Symposium. That same year, the NFMC was named one of four national Children's Safety Network Resource Centers. Through that designation, the NFMC has disseminated resources across the country on such issues as youth equestrian safety, helmet use and ATV and snowmobile safety.

In 1996 the NFMC spearheaded a national action plan for improving children's safety on farms, a plan that was later endorsed by Congress and became a blueprint for many advancements in child safety. In 1997 the NFMC was federally-funded to be the national coordinating center for childhood agricultural injury prevention.

More recently, NFMC staff coordinated the multi-disciplinary National Adolescent Farmworker Occupational Health and Safety Advisory Committee

NORTH AMERICAN GUIDELINES FOR children's AGRICULTURAL TASKS

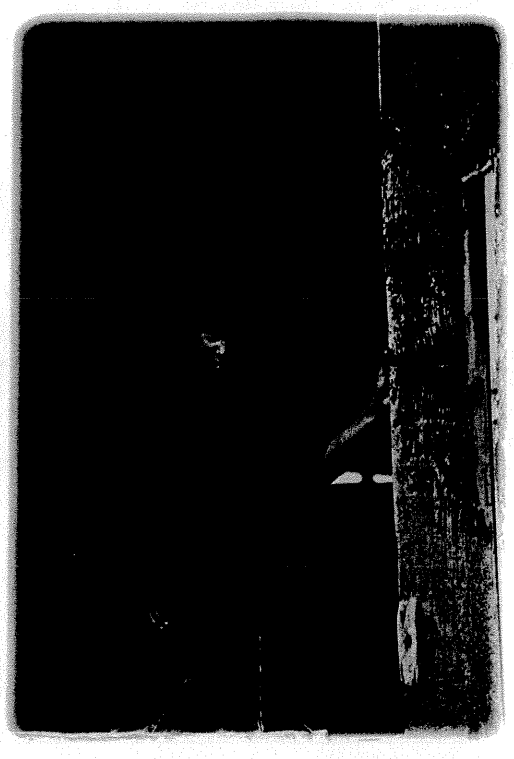
(NAFOHSAC), which developed a report as a planning tool to improve working conditions for adolescent farmworkers. In 2001 the NFMC hosted the National Summit on Childhood Agricultural Injury Prevention.

Environmental research

The Environ-mental Health and Reproductive Toxicology laboratories of the NFMC study the relationship between the rural environment and human health. The NFMC entered the environmental field in 1988 when it began a 3-year study on safe storage of fuels on farms

and ranches funded by the Amoco Corporation.

Mark Borchardt, Ph.D., and his Environmental Health Lab staff focus on waterborne diseases, agricultural zoonoses (diseases transmitted from animals to humans) and the evolution of pathogen virulence. Dr. Borchardt's lab recently completed a study on virus contamination of rural household wells, and also finished a study on farming risk factors for acute intestinal diarrhea in children.



The Reproductive Toxicology Lab of Anne Greenlee, Ph.D., studies occupational and residential rural exposures and how they may impact reproductive health. Her lab recently completed a study on commonly used agrochemicals for their effects on early development. She is currently working with Marshfield Epidemiologic Research Center on data analysis for a 5-year study investigating farming exposures and risk of infertility. The final report is anticipated in spring 2002.

Dr. Greenlee served as a member of the Wisconsin committee to create a statewide database for tracking pesticide sales and use.

To facilitate national discussion of environmental issues, the NFMC convened the Dean T. Stueland Summer Symposium 2001, "Examining Rural Environments for the Health and Safety of Children." Hailed as being "ahead of its time," the national symposium paid special attention to land use planning and subsequent environmental exposure as it relates to youth and rural communities.

Disease, injury prevention

In 1991, the National Institute for Occupational Safety and Health (NIOSH) selected the NFMC as home of the Midwest Center for Agricultural Research, Education, and Disease and Injury Prevention, with Paul Gunderson, Ph.D., and Dean Stueland, M.D., as co-investigators. It became one of nine such NIOSH agricultural centers in the nation, and formalized a structure for collaboration with cooperative extension in the five-state Midwest region.

Studies on injury prevention related to farm operations have included back pain prevention, hearing conservation and youth injury issues. Other research themes encompass rural women's health issues, cumulative trauma disorders, risk assessments of migrant farmworkers, skin cancer intervention evaluation, prostate cancer, and engineering control

technologies, such as safety sensors for equipment and toxic gas concentrations.

Other major efforts by the NFMC include its surveillance of farm trauma from 1987 through 1998, and its Guide to Tractor Roll Bars and Other Rollover Protective Structures, which continues to serve as a national reference manual.

Education

The National Farm Medicine Center uses all available means to disseminate information that will help researchers, farmers and professionals working in the area of farm safety and health.

NFMC's web sites are visited thousands of times each month. Visitors can access a tremendous array of resource material.

Cancer control

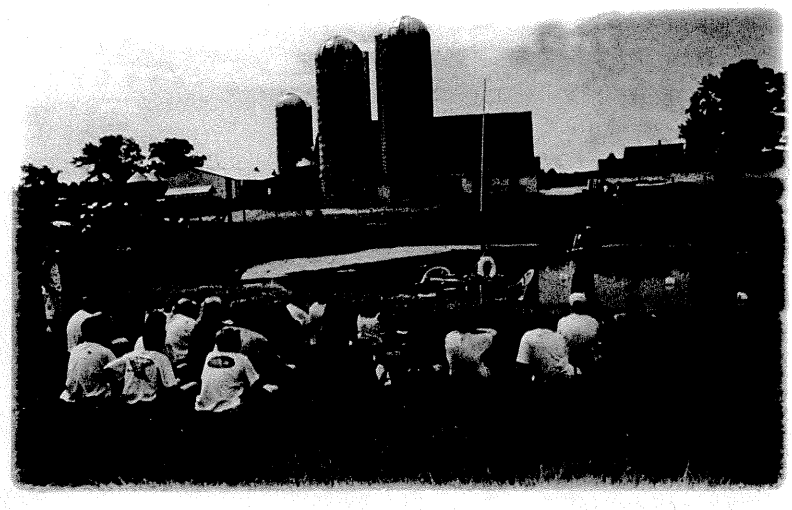
Through the leadership of Douglas J. Reding, M.D., M.P.H., Marshfield Clinic hematologist/ oncologist, the NFMC became involved in community-based cancer interventions. In 1992, the National Cancer Institute named the NFMC as one of ten Prostate, Lung, Colorectal and Ovarian Cancer Screening Centers in the United States. More than 17,000 people have enrolled in the Marshfield branch of PLCO.

The PLCO study and other rural cancer control programs grew so large that in 2001 they were transitioned into the new Rural Cancer Research Center, established within Marshfield Medical Research Foundation.

Forging partnerships

In order to make the greatest possible impact on the health and safety of farm families, the NFMC collaborates with organizations such as the Centers for Disease Control and Prevention, NIOSH, National Cancer Institute, National Safety Council, National Center for Farmworker Health, 4-H, FFA and others.

The NFMC continually evaluates its priority areas and specific objectives, and is committed to initiating and facilitating policy dialogue with professionals and farm organizations.



Funding

The majority of funding for the National Farm Medicine Center comes from competitive government grants and contracts. Marshfield Clinic provided an initial corporate contribution for development of the NFMC and continues to support the center. Other funding comes from private foundations, corporations, partnerships and donations.

Community support includes the estate of banker William D. Connor, who created a charitable trust to benefit the center.

Community volunteers are at the heart of the annual Auction of Champions, which has raised more than $700,000 for NFMC programs. The Auction began in 1982 when local radio station WDLB/ WLJY donated the championship steer from the Central Wisconsin State Fair to the NFMC. The Center had the steer processed and then auctioned the meat at a community dinner, raising more than $11,000. A tradition was born.

Proceeds raised through the Auction have been applied to a variety of agricultural health and safety-related projects. Recent projects have included the widely disseminated North American Guidelines for Children's Agricultural Tasks, as well as studies examining the impact of pesticides on reproductive health.

The future

The rural landscape continues to change. There are two million farms in the United States where workers conduct labor-intensive tasks. Although the overall number of working farms has declined, the size of those farms has increased and the agricultural work force is growing more diverse.

The sprawl of urban populations into rural areas raises new issues, as well. Unplanned rural development can impact groundwater quality, present problems for wastewater disposal, juxtapose subdivisions next to large agricultural operations and increase traffic volume on under-designed roads. The public health issues that arise from these development pressures have not been fully assessed.

But the core priorities of the National Farm Medicine Center have not changed in 20 years. The NFMC will continue listening to farmers and serving their unique health and safety needs.

DOCTORS EMANUEL, STUELAND MADE INDELIBLE IMPACTS ON NFMC

The Deans of farm medicine

They shared names, professions and a desire to improve the health of the American farmer.

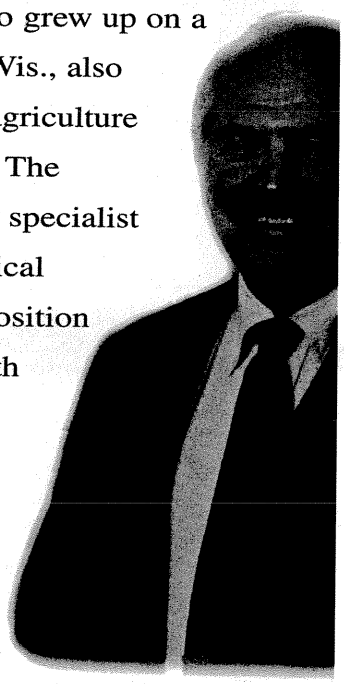
The two Deans of the National Farm Medicine Center, physicians Dean Emanuel, M.D., and the late Dean Stueland, M.D., M.P.H, put a face on a fledgling organization.

"They were probably the two most credible people we had from the perspective of the farmers," said John McCarty, former assistant director of educational programs with the National Farm Medicine Center.

"People knew of Dean Emanuel because of the pioneering research he had done on Farmer's Lung disease," McCarty said. "And Dean Stueland had a farm background, and could relate to any agricultural audience."

Dr. Emanuel, a cardiologist, was the first director of the NFMC, and holds the title Medical Director Emeritus. His desire to focus on the study, treatment and prevention of diseases that affect farmers helped lead to the creation of the NFMC at Marshfield Clinic in 1981.

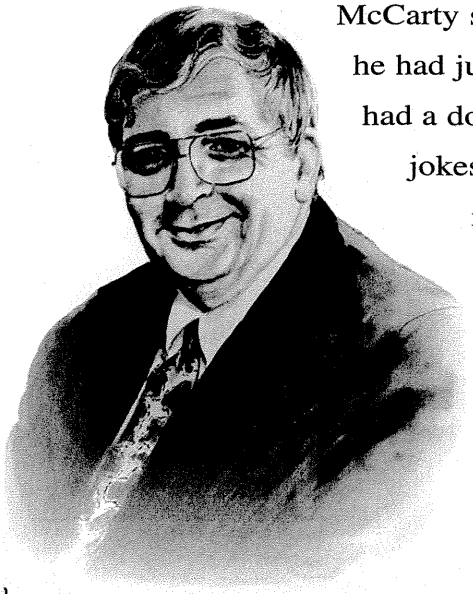
Dr. Emanuel, who grew up in the small town of Augusta, Wis., was referred to as "one of the country's foremost specialists in rural medicine" by Farm Industry News magazine. He laid the foundation for the NFMC in the 1960s and 1970s with research on respiratory disease in farmers.



Dr. Stueland, who grew up on a farm near Viroqua, Wis., also was well-known in agriculture and research circles. The emergency medicine specialist became NFMC medical director in 1986, a position he held until his death from cancer in 2000. His interest in the NFMC stemmed from his farm background and from the agriculture-related injuries he saw in the Emergency Department.

McCarty said Dr. Stueland had a down-to-earth rapport with the farm community. He remembers a seminar that the NFMC sponsored regarding farm injury rescue training.

"The emergency medical technicians were all there when Dean arrived,"



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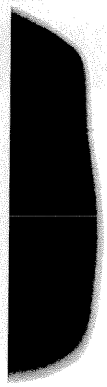
and, M.D., M.P.H.

McCarty said. "His T-shirt was sweaty because he had just finished feeding his horses, and he had a donut in his hand. He told a couple good jokes and then proceeded to deliver relevant information that would help these EMTs do their jobs better."

Neither Dean Emanuel nor Dean Stueland forgot where they came from. Their research interests reflected as much.

Shortly after joining Marshfield Clinic in 1958, Dr. Emanuel frequently found himself telling farmers in their 40s or 50s that they had Farmer's Lung disease, a form of allergic pneumonia caused by inhalation of mold spores that grow in baled hay, stored grain or silage with high moisture content. This diagnosis often meant the farmer had to find a different career – and different way of life.



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In 1959, Dr. Emanuel obtained a $40,000 federal grant to study Farmer's Lung, opening the door to understanding and preventing what had been a debilitating disease.

Dr. Stueland, who was Marshfield Clinic vice president at the time of his death, saw the dangers of farm work from an emergency room perspective. His hospital-based surveillance of agriculture injuries in central Wisconsin from 1987 to 1998 provided long-term, detailed data on who was being injured, when and how. Researchers across North America continue to cite his work.

Dr. Stueland was instrumental in improving pre-hospital trauma care in central Wisconsin. During the 1980s he led efforts to put defibrillators in ambulances, and he worked with local fire departments to improve their expertise in farm injury rescues.

Their work continues through endowment funds

From smalltown roots to big-time medicine and research, the Deans of the National Farm Medicine Center made a difference.

Endowment funds in their names assure that the work and interests of these two research-minded physicians will continue.

The Emanuel endowment will fund the Dr. Dean A. Emanuel Research Chair at the National Farm Medicine Center. It was established in 1999 by retired physicians and the local community, and fulfills Dr. Emanuel's dream of continued clinical research.

The Dr. Dean T. Stueland Endowment Fund, established in 2000, is earmarked for studies in agricultural medicine, emergency medicine and alcohol/other drug abuse medicine.

For information on either fund, contact the Marshfield Clinic Resource Development Office, 715-387-9249, or 1-800-858-5220.