
TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Case No. 2010 IA 017 Report date: 10 October 2012

SUBJECT: Fatal burn injury while bulldozing and burning brush

SUMMARY

A 74-year-old self-employed construction worker died in 2010 from severe burns to his upper body. The victim had been bulldozing trees and brush into a burn pile at a friend's rural property when a fire of unknown origin started in the bulldozer and led to a 65% full-thickness circumferential burn to the victim's upper body, arms, and head. The bulldozer operator was able to exit the machine and drove his truck to a nearby field to get help from the property owner's son. The property owner's son called 911, but the dispatcher could not locate the address, so the property owner drove the injured man to a local hospital less than 20 miles away. The victim was then airlifted to a level 1 burn treatment center 60 miles away. Due to the extent and severity of his burns, he was taken off life support the following day, and died one day later.

RECOMMENDATIONS

1. *Open fires should always be attended and supervised. Machinery should not be operated near open flames.*
2. *Keep a fully charged Class ABC-rated fire extinguisher in the cab or accessible storage area of farming and construction machinery.*
3. *Individuals should be aware of state safety policies for open burning and permit requirements for burns.*
4. *When burning trash or outdoor debris, contact the local fire department and advise them of your plans and location.*
5. *Plan for accessing emergency services. Individuals should contact local dispatchers to make sure adequate information is available to locate the residence or burn area.*
6. *Individuals should not work alone in risky conditions, such as when working with an open fire. When working alone in isolated areas, individuals should have plans to summon emergency assistance.*
7. *Machinery should be maintained in good condition and inspected before use, with specific attention to fuel lines and possible leaks.*

INTRODUCTION

Iowa FACE initiated an investigation within two weeks of the event. Evidence for this report includes the State Medical Examiner's report, the county sheriff's investigation report, and interviews with the victim's son, a representative from the bulldozer manufacturer, and a fire investigator.

INVESTIGATION

The victim was a self-employed construction worker with more than 20 years of experience in the field and 16 years of professional experience driving a bulldozer. The victim was helping a friend clear trees and brush from a field, and he was using the bulldozer to push trees, brush, and debris into a burn pile. The victim was operating a 1978 diesel-fueled bulldozer that he owned and maintained.

When the bulldozer operator arrived in his truck to start work the morning of the incident, he parked near the field entrance, and then lit existing brush piles and began to work the piles around and together into a large pile. At about 1530, the property owner's son went to check on the bulldozer operator and found "everything was going okay." The bulldozer operator was working brush into a large burn pile approximately 20-25 yards in diameter and 50 yards from the road. Wind was from the north/northeast, and the victim was pushing brush northwards into the back side of the burning pile¹.



Exhibit 1: Burn pile and burn area on ground where bulldozer is believed to have caught fire

¹ According to data from a regional weather station (approximately 23 miles away from the site), winds were blowing from 10 to 14 mph with gusts up to 18.4 mph.

At approximately 1730, the bulldozer caught fire roughly 20 yards southwest of the burn pile (based on subsequent examination of the burn area on the ground, Exhibit 1) in what the operator described as a fireball. Although the operator was severely burned, he managed to put the bulldozer in reverse, jump from the bulldozer, and make his way to his truck parked near the field entrance.

The victim drove himself over two miles to the field where he knew the property owner's son was working. He told the son to call 911, and that there was a "big ball and flame" and that he had left the bulldozer in reverse while getting away from the fire. At this same time, the property owner, who was disking across the road, saw the victim arrive and drove over to find out what was going on. The victim was severely burned and likely in shock, and provided no further information about the event.

The property owner's son immediately called 911. The local 911 dispatcher could not locate the reported rural address in her computer system, so the property owner drove the victim to the local hospital. There, the victim was sedated and intubated, and transferred by helicopter to a level 1 burn treatment center, approximately 60 miles away, arriving at approximately 2000. The following morning, the attending physician met with the victim's family to inform them that the extent and severity of the victim's injuries were not survivable. Life support was removed and the victim was placed on comfort care. He died the following afternoon (two days after the incident).



Exhibit 2: Location where bulldozer came to rest

Investigation of the site showed that the bulldozer had traveled southwest in reverse, one-quarter to one-third mile until it ran into some trees (Exhibit 2). It remained in that position with the engine still running,

until the property owner's son went to the site after his father and the victim departed for the hospital. It was estimated the bulldozer had continued to run for at least 30 minutes after the fire started.



The day after the incident, the Sheriff's office investigated and found that the seat and battery compartment under the seat were severely burned (Exhibit 3). There was a slight burn on the console, but no other burned areas on the bulldozer. When the bulldozer was turned on, there was no evidence of any hydraulic leaks running under the seat console.

The exact cause of the fire has not been determined, and it is not known if the fire started on the bulldozer or the driver. However, evidence suggests that the victim somehow may have gotten an accelerant or burn source on his clothing, which is consistent with the severity of the burns and the location primarily on the upper body. A nurse at the first hospital reported the victim's clothing smelled like diesel or gasoline. Because the burns were primarily on the upper body, it is presumed that the fire did not start in the under-battery compartment. Since the damage to the bulldozer was concentrated on the seat, with non-concurrent burns to the victim's buttocks and lower legs, it is most likely that the burns to the seat compartment occurred after the victim exited the bulldozer. Since the bulldozer continued to operate for at least 30 minutes after the fire started, the fuel source is not likely to be a fuel or fluid leak, which would have been exhausted from the fire.

Several fire sources are possible:

- An ember from the burn pile caught the driver or bulldozer on fire. Consultation with John Walker, a fire investigation expert, indicated that such a severe fire would only occur from a floating ember if there was some sort of fuel. A nurse reported smelling gas or diesel on the victim, but the victim's shirt was completely burned and determining if it was soaked with a fuel source was not possible.
- Another fuel source could have been a leak of hydraulic fuel from the bulldozer. When the bulldozer was turned on after the event, there was no indication of a leak. However, the victim's son reported on interview that the victim had recently been working on the bulldozer. Phone calls to a supply company could not confirm exactly which parts had been purchased or what had been fixed.
- The debris in the burn pile caused a fireball, igniting the bulldozer or driver. According to John Walker, a "fire ball" from the burn pile would only be possible if there were a fuel source in the burn pile. IOWA FACE investigators did not conduct a search through debris at the site, but sheriff

investigation report photos of the burn pile showed a variety of debris including concrete rubble, old wire fence, corrugated metal, and rusted cans, in addition to brush and tree stumps.

CAUSE OF DEATH

The Medical Examiner's examination reported the cause of death as 65% full thickness circumferential burns. An autopsy was not performed.

RECOMMENDATIONS AND DISCUSSION

Recommendation 1: *Open fires should always be attended and supervised. Machinery should not be operated near open flames.*

Fire investigation expert John Walker described open burn piles as "treacherous" and cautioned that work should not be done near open burns. The Massachusetts State Fire Marshall recommends that an adult attend open fires at all times when they are burning. Machinery should not be operated near an open burn.

Recommendation 2: *Keep a fully charged Class ABC-rated fire extinguisher in the cab or accessible storage area of farming and construction machinery.*

At a minimum, a 10-pound ABC fire extinguisher should be mounted inside the cab of mobile farming equipment. Ideally, a second extinguisher should be mounted outside the cab to be accessible from the ground. There was no extinguisher on the bulldozer.

Recommendation 3: *Individuals should be aware of state safety policies for open burning and permit requirements for burns.*

State Fire Marshall Offices often have policies that require permits for open burns (which will inform authorities of when and where open fires will be ignited) with guidelines for appropriate materials, ignition practices, and conditions. For example, the Massachusetts Fire Marshall recommends that open fires not be set with even minimal wind conditions. In this event, winds throughout the day had increased, with wind speeds estimated at 10 – 14 mph with gusts up to 18.4 mph.

Recommendation 4: *When burning trash or outdoor debris, contact the local fire department and advise them of the plans and location.*

Contacting a local fire department will ensure compliance with local permits or ordinances. They may also advise a worker regarding hazardous fire conditions and recommend a safer time to burn outdoors. More importantly, the fire department will be aware of the actual work location if an emergency call is necessary.

Recommendation 5: *Plan for accessing emergency services. Individuals should contact local dispatchers to make sure adequate information is available to locate the residence or burn area.*

Persons residing in areas without expanded 911 coverage should contact their police dispatchers to determine whether their address is included in the dispatch database. Rural residents should post clear, concise directions to their location at each telephone in the event of an emergency; it is also recommended that neighbors exchange addresses so as to be able to direct responders to other nearby residences. In the

absence of information about the location, the Sheriff investigating this event recommended that the dispatcher send an ambulance anyway and stay on the line to direct the ambulance to the location.

Recommendation 6: *Individuals should not work alone in risky conditions, such as when working with an open fire. When working alone in isolated areas, individuals should have plans to summon emergency assistance.*

In risky situations such as open fires and/or use of heavy machinery, it is highly preferable not to work alone. When working alone, plans to facilitate calls for help and a quick response should be in place. For example, a cell phone with tested access to service or walky-talky should be available to the isolated worker. Individuals should ensure that regular checks on their welfare will be conducted.

Recommendation 7: *Machinery should be maintained in good condition and inspected before use, with specific attention to fuel lines and possible leaks.*

Machinery should be in good condition to ensure safe operation. Check for hydraulic leaks at fittings and by looking for drips onto cardboard or other surfaces placed below the machine prior to using it in the field. Special attention should be paid to fuel lines and other sources of flammable liquids, especially if the machinery will be near open flames.

Keywords: bulldozer, fire, brush, equipment operator, fire on vehicle

References

“Safety Tips for Open Burning Season” FireFACTORS. Office of the State Fire Marshall, Department of Fire Services, Stow, Massachusetts. <http://www.mass.gov/eopss/docs/dfs/osfm/pubed/flyers/open-burning-fire-factors.pdf>

A prospective analysis of trash, brush, and grass burning behaviors. Wibbenmeyer LA, Kealey G, Young T, Newell I, Lewis R, Miller B, Peek-Asa C. Journal of Burn Care and Research 29(3), 2008; 441-445.

Fire Dozer Safety. California Dozer Operators Group.
<http://www.californiadozeroperatorsgroup.org/safetypage.html>

John Walker, Fire Forensic Engineer, Walker Fire Forensic Analysis, Spencerville, Indiana. Personal communication.

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**Fatality Assessment and Control Evaluation
FACE**

Fatality Assessment and Control Evaluation, FACE, is a program of the *National Institute for Occupational Safety and Health* (NIOSH), which is part of the *Centers for Disease Control and Prevention* of the U.S. *Department of Health and Human Services*. Nationally, the FACE program identifies traumatic deaths at work, conducts in-depth studies of select work deaths, makes recommendations for prevention, and publishes reports and alerts. The goal is to prevent occupational fatalities across the nation.

The NIOSH head office in Morgantown, West Virginia, carries out an intramural FACE case surveillance and evaluation program and also funds state-based programs in several cooperating states. In Iowa, *The University of Iowa* through its *Injury Prevention Research Center* works in conjunction with the *Iowa Department of Public Health* and its *Office of the State Medical Examiner* to conduct the Iowa FACE program.

Nationally, NIOSH combines its internal information with that from cooperating states to provide information in a variety of forms which is disseminated widely among the industries involved. NIOSH publications are available on the web at <http://www.cdc.gov/NIOSH/FACE/> and from the NIOSH Distribution Center (1-800-35NIOSH).

Iowa FACE also publishes its case studies, issues precautionary messages, and prepares articles for trade and professional publication. In addition to postings on the national NIOSH website, this information is posted on the Iowa FACE site, <http://www.public-health.uiowa.edu/FACE/>.

The Iowa FACE team at the University of Iowa includes Marizen Ramirez, Director; Corinne Peek-Asa, Co-Investigator; John Lundell, Co-Investigator; T. Renée Anthony, Co-Investigator; and Murray Madsen and Stephanie Leonard, Field Investigators. Additional expertise is provided from the Iowa Department of Public Health, including Rita Gergely, Principal Investigator; Kathy Leinenkugel, Surveillance Specialist; and John Kraemer, Director, Forensic Operations at Iowa Office of the State Medical Examiner.

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