

MIFACE INVESTIGATION REPORT: #08MI062

SUBJECT: Machinist Dies When He Came Into Contact With a Rotating Vertical Cutting Head of a Gantry Mill.

Summary

In the summer of 2008, a 48-year-old male machinist died when he came into contact with a rotating vertical cutting head of a gantry mill (Figure 1). The decedent programmed the gantry mill to begin a milling operation. Leaving the remote pendant attached to the gantry mill frame, he walked approximately seven feet to the home position of the cutting head near the south end of the part being machined. The head descended to perform the cut and then moved at cut height west to east to align with the starting point of the cut. The head began traveling north into the material (Drawing 1).



Figure 1. Cutting head of vertical gantry mill and part being machined

At some point during the head movement, the decedent came into contact with the rotating head and his body was drawn into the cutting head. The decedent's activities leading to the event were unwitnessed. Possible activity scenarios include: a) using an air hose/blow gun to remove chips, b) preparing/finishing laser measurements to ensure cutting accuracy, or c) preparing to apply lubricant to the cutting area. He sustained both head and upper torso injuries. A coworker observed the decedent being drawn into the cutting head. The coworker ran to the machine and yelled for help, but because he did not know the machine's operation, did not hit the emergency stop. A representative from the firm for whom the part was being manufactured was nearby taking measurements. He ran to the incident scene and activated the emergency stop. The owner was called to the scene. The owner, part representative and coworker initiated CPR and attempted to stop the bleeding. Emergency response arrived and the decedent was transported by helicopter to a nearby hospital where he was declared dead.

RECOMMENDATIONS

- Employers should require that cutting head movement be stopped prior to the operator performing work near the point of operation.
- Machine manufacturers should include an emergency stop on pendant remotes. If the remote does not have an emergency stop, machine owners should contact the manufacturer to inquire if the remote could be retrofitted with an emergency stop.

- The employer should consider applying a non-skid/anti-slip coating or another method (tape, mats, etc.) to increase the operator's traction when walking to the point of operation from the operator's station.
- Employers should inform appropriate employees about the operation of each piece of machinery and when to activate the emergency stop in case of injury or malfunction.
- Employers should establish a health and safety (H&S) committee as a part of their health and safety program.

In addition, MIFACE recommends:

- The employer should consider a vacuum system instead of compressed air to remove chips from the machining area.
- The employer should consider investigating whether a wireless remote pendant for operator use is applicable.
- The employer should activate the gantry mill's closed circuit TV camera.

INTRODUCTION

In the summer of 2008, a 48-year-old male machinist died when he came into contact with a rotating bit of a milling machine. On the same day, MIOSHA General Industry Safety and Health division personnel notified the MIFACE program that the above incident had occurred. On August 1, 2008, the MIFACE researcher interviewed the company owner and the night shift operator of the machine involved in the incident. During the course of writing this report, the police report, death certificate, medical examiner report, and the MIOSHA file and citations were reviewed. The pictures used in this report were taken at the site visit with the permission of the company owner.

The tool and die company for whom the decedent worked was a 52-year-old family owned business. The machine shop did prototyping, jobbing and repair. There were 32 individuals employed at the firm, 13 of whom had the same job title as the decedent: machinist. The decedent had been employed by this firm for six years as an hourly, full-time worker. He had six years of experience operating this type of machinery, and had operated this type of equipment at prior employers. His work shift was 12 hours, beginning at 5:30 a.m. and concluding at 5:30 p.m. He had been working approximately 5 hours on the day of the incident. The incident occurred approximately 1.5 hours after his 9:00 a.m. break.

The employer had a written health and safety program. The firm required eye protection and a hard hat when employees operated the firm's overhead crane. The firm provided uniforms with short sleeves.

There were no written safety rules/procedures in place for the specific task being performed by the decedent. The company owner was responsible for administering the safety program. The firm did not have a safety and health committee. Safety meetings with employees were held as the employer deemed necessary.

The employer stated he hired only trained personnel. The employer sent employees to a local community college to receive additional training. Training records were not maintained. Machine operators demonstrated to other employees/company owner that they knew how to safely and accurately perform a specific task prior to being permitted to operate that machine.

MIOSHA General Industry Safety and Health Division did not issue a citation to the firm at the conclusion of its investigation. The Division issued the following recommendation: install and utilize a device for chip removal and lubrication in the gantry mill.

Firm Remediation

The employer contacted the gantry mill manufacturer to respond to the MIOSHA recommendations.

The gantry mill manufacturer indicated that there was no automatic system for chip removal and delivery of lubrication oil.

The firm also requested that the manufacturer provide information as to whether an emergency stop could be placed on the remote pendant. The response from the manufacturer stated that an emergency stop could be installed by the firm but that there would not be the ability to change the connection of the remote during the “whole part” program. The remote had to stay connected on the side of the machine.

The employer has posted a sign stating that the operator must stay on the platform while the machine is in “Auto Cycle”.

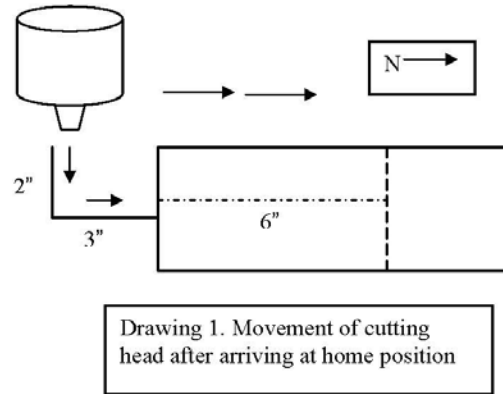
INVESTIGATION

The vertical gantry boring, drilling and milling machining center accepted material 50 feet long and 15 feet wide to be worked. The mill was eight to ten years old. The mill operated in three directions: X (length of part), Y (across part) and Z (up and down). The operator controls for the gantry mill were located in a cab that was mounted on the southwest corner of the frame. A closed circuit TV camera was mounted on the north side of the cab’s exterior wall with a monitor in the cab. The door of the cab was seven feet away from the “home” position of the cutting head. The 5/8-inch diameter, 1 1/2-inch long cutting head tracked East/West/East across the gantry frame and the gantry moved North/South across the material being worked. When the cutting head was in operation, it rotated at 2,500 rpm. As the cutting head was being positioned, it operated at 600 rpm. A portable cable-connected remote, with its back magnetically attached to the frame of the machine, could be used by the operator to position the cutting head. The mill was equipped with an emergency stop, but the remote did not have emergency stop capability.

The 14 1/2-foot by 50-foot long part being milled at the time of the incident was an engine mount for an ocean liner. The surface of the part being worked was 52 inches above the walking surface near the machine. The firm had been machining the part for

nearly three weeks, and it was scheduled to come off the mill the afternoon of the incident day. The decedent had programmed the machine to take off 1/15,000th of an inch of material. A laptop computer connected to a laser measuring system was on top of the material being worked and to the east of the cutting head.

The night shift operator of the gantry mill reviewed the operating history on the computer system at the time of the MIFACE site visit. The operator determined that the decedent had programmed the mill to start at 30 inches above the part 105 inches north of the south edge of the part to be milled. The cutting head traveled to “home” position, descending to 3 inches south of the south edge of the part, two inches west and 30 inches above the part. The head descended to perform a 2-inch cut while still 3 inches south and 2 inches west from the edge of the material to be worked. The head then traveled east 2 inches and then north 3 inches to begin the cut. The head was moving north from south edge at 1100 rpm, 25 inches per minute.



Not To Scale

During machine operation, it was common practice for the machine operator to leave the cab to a) use an air hose with blow gun to remove chips, b) to apply lubricant to the cutting area, and c) to perform laser measurements to ensure the part was being machined appropriately.

The event was un-witnessed. It is unknown what activity the decedent, who was not holding the remote pendant, was performing when he was drawn into the cutting head. The MIFACE researcher noted that the work platform of the milling machine was slippery. The decedent may have lost his balance while performing a task or while walking causing him to contact the rotating drill.

A nearby coworker heard strange sounds coming from the machine area. When he looked over at the milling machine, he observed the machine drill bit pulling the decedent up into the machine. He was being choked because his clothing had wrapped around the cutting head chuck. The coworker ran to the machine and yelled for help, but because he did not know the machine’s operation, did not hit the emergency stop. A quality inspector for the part being machined was taking measurements on cuts that had already been made. The inspector was standing approximately 12 to 15 feet away from the incident site at the west side of the material, north of the gantry facing away from the cutting area. Upon hearing the decedent’s coworker screaming for help, the quality inspector turned and looked to the south where he observed the operator caught in the machine. The inspector ran to the cab and hit the emergency stop. The computer information revealed that it took 45 seconds from the time the machine was initiated to the activation of the

emergency stop. The cutting head had moved 6 inches north on the part prior to the emergency stop being initiated.

The firm's owner was summoned to help free the decedent, who was being held upright by the cutting head chuck. The machine was restarted and the cutting head raised 6 inches to free the operator. After the cutting head was raised up, the decedent slumped from his upright position to a prone position.

After the decedent was on the ground, the owner, inspector and coworker began first aid and CPR. The decedent was bleeding profusely so the owner attempted to stop the bleeding by using towels and applying pressure to the injured area. Blankets were spread over the decedent to prevent shock. CPR was administered until the emergency units arrived. The decedent was transported by helicopter to a local hospital where he was declared dead.



Figure 2. Picture of severed air hose

A severed air hose used to blow chips from the part was found west of the part on the track floor (Figure 2). The night shift operator postulated that the hose may have been positioned around the decedent and the hose was caught by the rotating cutting head chuck. A rubber mark was found on the chuck approximately 2-1/2 inches from its base. The wound area contained yellow and black debris (the color of the air hose). The owner indicated that the air gun and approximately one foot of hose was removed by the biohazard clean-up crew.

The owner did not know why the decedent had left the cab and approached the material to be worked after the gantry mill program had been initiated without stopping the tool.

The MIOSHA compliance officer reviewed the operator's manual for the machine. The officer noted in the MIOSHA file that the manual contained warnings on operations such as, but not limited to, the manual changing of cutting head. No warnings were included regarding the operator leaving cab without bringing the equipment to a stop or carrying the portable cable connected remote.

CAUSE OF DEATH

The cause of death as listed on the death certificate was multiple injuries. Toxicology was negative for alcohol and illegal drugs.

RECOMMENDATIONS/DISCUSSION

- Employers should require that cutting head movement be stopped prior to the operator performing work near the point of operation.

To address the hazard presented by the rotating cutting head, the employer has mandated that the operator stay on the operator's platform when the machine operates in Auto Cycle. The cutting head was engaged as the decedent neared the work area to blow chips, conduct measurements, or lubricate the cutting area. To ensure operator safety, MIFACE recommends that when work is to be performed by the operator in the vicinity of the rotating cutting head, that the machine be stopped before performing the work. When the operator is clear of the point of operation, the head can be re-engaged.

- Machine manufacturers should include an emergency stop on pendant remotes. If the remote does not have an emergency stop, machine owners should contact the manufacturer to inquire if the remote could be retrofitted with an emergency stop.

After the incident, the firm contacted the manufacturer to inquire as to whether an emergency stop could be installed on the pendant control. Although the manufacturer indicated there would be limitations of use of the pendant, an emergency stop could be added. Machine manufacturers should include an emergency stop on any pendant control. If a pendant control does not have an emergency stop, the company using the machine should inquire whether retrofitting the pendant is possible.

- The employer should consider applying a non-skid/anti-slip coating or another method (tape, mats, etc.) to increase the operator's traction when walking to the point of operation from the operator's station.

It is unknown if the decedent lost his balance as he was walking toward or working near the rotating drill. The company should investigate whether a non-skid/anti-slip coating would be appropriate for this work area. Factors to consider in selection could include chemical resistance, inside versus outside use, applicability for oils, application method, and price.

- Employers should inform appropriate employees about the operation of each piece of machinery and when to activate the emergency stop in case of injury or malfunction.

In this incident, the lack of knowledge of the decedent's coworker regarding the operation of the machine delaying the activation of the emergency stop most likely did not affect the final outcome. Employers should inform appropriate employees about the operation of each piece of machinery so that in case of an emergency, they would be comfortable in ceasing the operation of the machine by activating the emergency stop.

- Employers should establish a health and safety (H&S) committee as a part of their health and safety program.

An H&S Committee, comprised of both management and hourly employees provides a forum for management and employees to regularly discuss health and safety issues in the workplace. An H&S Committee is an important way for employees to help manage their own health and safety and assist the employer in providing a safer, healthier workplace. The formation of the Committee provides a process for open communication on health and safety issues and enhances the ability of employees and management to resolve safety and health concerns reasonably and cooperatively. Conducted appropriately, it reinforces management's commitment to a safe and healthy work environment and provides employees with a platform to voice their concerns regarding consistent enforcement of company health and safety policies.

MIOSHA has several resources that can be accessed on the Internet to assist an employer in the development of an effective H&S Committee. The *Good Safety and Health Programs are Built with Good Safety Committees* brochure (www.michigan.gov/documents/cis_wsh_cet0140_103132_7.pdf) details the advantages of having an effective H&S Committee. The MIOSHA Safety and Health Toolbox, which can be found at the homepage of MIOSHA Consultation, Education and Training Division, contains materials that focus on the major components of a health and safety system. Module 2 of the Toolbox focuses on employee involvement and contains several resources for Health and Safety Committee development. The MIOSHA CET Division website can be accessed through the Michigan Department of Energy, Labor & Economic Growth website at <http://michigan.gov/dleg>. Click on the MIOSHA link located in the box on the left side of the web page, then click on the Consultation, Education, and Training link. MIOSHA CET can also be contacted by telephone: (517) 322-1809.

The State of Wisconsin "Guidelines for Developing an Effective Health and Safety Committee" (www.doa.state.wi.us/docs_view2.asp?docid=665) and the Canadian Centre for Occupational Health and Safety, Occupational Safety and Health Answers: Health and Safety Committees (www.ccohs.ca/oshanswers/hsprograms/hscommittees/) both provide valuable resources and a framework for selection of H&S Committee membership, purpose, function, and activities.

Additionally, MIFACE recommends:

- The employer should consider a vacuum system instead of compressed air to remove chips from the machining area.

The chips produced by milling can be razor sharp. The firm's work practice was to use compressed air to remove the chips from the part. MIOSHA General Industry Safety and Health Standard, Part 1, General Rules, Rule 36 (Air under pressure) states "When air under pressure is used to remove chips and dust, a chip guard, such as a fixed or removable shield, safely located, shall be provided to protect an employee in an adjacent area. The employee using air under pressure shall be provided with and use the personal protective equipment as prescribed in Part 33, Personal Protective Equipment, being

R408.13301 et seq. of the Michigan Administrative Code, to the extent necessary to protect against hazards created by the operation.”

MIFACE encourages the employer to investigate options to replace the use of compressed air for chip removal. One option to minimize the risks posed by flying chips is a vacuum system. Additionally, tools such as a chip scraper or stout brush with a sufficiently long handle to keep workers away from moving parts could be considered.

- The employer should consider investigating whether a wireless remote pendant for operator use is applicable.

The part being milled was 14-1/2-feet wide by 50-feet long. The remote cables limited the mobility of the operator to move the length of the part, as well as posed tripping and entanglement hazards. Wireless remote pendants are gaining acceptance in the manufacturing industry. MIFACE consulted with MIOSHA, and MIOSHA determined that wireless remote pendants were acceptable when a remote pendant was required, was compatible with the machine operation, approved by its manufacturer, and other operations that may be in the vicinity.

- The employer should activate the gantry mill’s closed circuit TV camera.

It is unknown why the camera was not activated. MIFACE recommends that as part of the machine maintenance program that one of the tasks performed is to ensure the camera is operational and available for use by the equipment operator as required by the operation.

REFERENCES

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

- MIOSHA General Industry Safety and Health Standard, Part 1, General Rules.
- Milling – Bray Lab Machine Shop, Tufts University. Internet Address: <http://ase.tufts.edu/mechanical/shop/classes/me1/milling.html>
- *Bluetooth Improves Control of Big Machine*. Modern Machine Shop, July 2007. Internet Address: http://findarticles.com/p/articles/mi_m3101/is_2_80/ai_n19362125/

Key Words: Machine, Entanglement, Gantry Mill

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MIFACE

Investigation Report #08 MI 062

Evaluation

To improve the quality of the MIFACE program and our investigation reports, we would like to ask you a few questions about this report, using a scale of Excellent=1, Good=2, Fair=3, and Poor=4.

What was your general impression of this MIFACE investigation report?

Excellent	Good	Fair	Poor
1	2	3	4
<i>Was the report...</i>			
		Excellent	Good
		1	2
		3	4
		Fair	Poor
		1	2
		3	4
		Useful?	Useful?
		1	2
		3	4
<i>Were the recommendations ...</i>			
		Excellent	Good
		1	2
		3	4
		Fair	Poor
		1	2
		3	4
		Useful?	Useful?
		1	2
		3	4

How will you use this report? (Check all that apply)

- Distribute to employees/family members
- Post on bulletin board
- Use in employee training
- File for future reference
- Will not use it
- Other (specify) _____

Thank You!

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Comments:
