



The National Institute for Occupational Safety and Health (NIOSH)

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through safety and health research



Extrusion Machine Operator Dies of Head Injuries Received When His Head Became Caught in Extrusion Machine Rollers – South Carolina

FACE 9406

SUMMARY

A 25-year-old male extrusion machine operator (the victim) died after his head was crushed between two extrusion machine rollers. The victim was operating the extrusion machine at a facility that produced polyester/nylon monofilaments. The mono-filament production process began with the loading of polyester nylon chips into a hopper for melting, followed by a cooling cycle, die extrusion, and passage through a series of three ovens. After the filaments exited the third oven, they passed through a series of five, 8-inch-diameter rollers before going to the accumulator, where the properties were checked prior to being fed onto spools. The event was unwitnessed; however, it is assumed that, as one of the filaments exited the last oven, it broke and began to accumulate around the end of one of the rollers. In an attempt to clear the filament from the end of the roller, the victim became entangled and his head was pulled between two of the rollers. A co-worker operating a nearby machine looked over to see the victim come to an upright position before falling over. He notified the supervisor, who called the emergency medical squad (EMS). The supervisor and co-worker tried to contain the bleeding until the EMS arrived. The EMS transported the victim to the hospital where he was pronounced dead by the attending physician. NIOSH investigators concluded that, in order to prevent similar incidents, employers should:

- **equip machines with safety trip controls and guard rollers that might be inadvertently contacted by workers**
- **instruct employees not to attempt to clear fouled material from rotating rollers**
- **evaluate means to prevent broken monofilaments from building up on machine rollers.**

INTRODUCTION

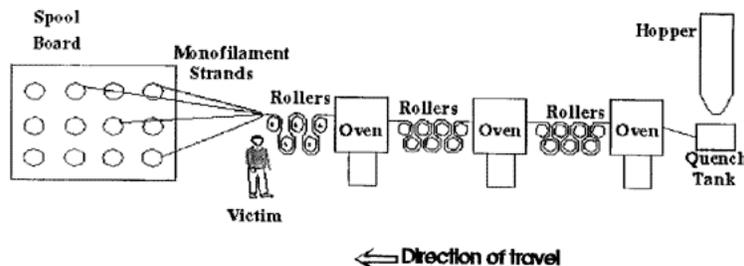
On March 14, 1994, a 25-year-old extrusion machine operator (the victim) died after his head was pulled through two rollers on the extrusion machine he was operating. On March 15, 1994, officials of the Occupational Safety and Health Administration of the state of South Carolina (SCOSHA) notified the Division of Safety Research (DSR) of this fatality, and requested technical assistance. On March 22 and 23, 1994, a DSR safety specialist conducted an on-site investigation. The incident was reviewed with SCOSHA officials, employer representatives, and the county coroner. The incident site was photographed during the investigation.

The employer was a manufacturing facility that produced polyester/nylon monofilaments. The facility had been in operation for 37 years, and employed 285 workers. The employer had a written safety policy and written safe work procedures. Monthly safety meetings were held prior to the start of each shift and were conducted by the shift supervisor. Workers received training on the job. Extrusion machine operator trainees received specialized and structured training. Each trainee was assigned to a trainer, and worked with that trainer until such time that the trainer determined that the trainee could operate the machine competently, and in a safe manner. The employer furnished workers with safety glasses, and yearly first aid refresher courses were held for all employees. This was the first fatality experienced by the employer. The victim had worked for the employer for 12 years.

INVESTIGATION

The facility produced polyester/nylon monofilaments that were used for monofilament fishing line, weed-eater line, industrial sewing thread, and in the production of belts for paper mills. The facility operated on two 12-hour production shifts at 42-day intervals. Production crews would work 4 days, then have 4 days off while two other production crews worked their 4-day cycle. A typical production crew consisted of 25 to 30 extrusion machine operators, 2 maintenance men, and a quality assurance auditor.

The production/extrusion process started with polyester/nylon chips being fed into a hopper barrel and being melted at 470° to 550° F, depending on the material. The liquid material was then gravity fed into dies (depending on the size of the finished material) in a quench tank containing 80° F water, where it was partially hardened. The monofilaments then passed through a series of three ovens (the orientation process) where properties such as degree of stretch and the tensile strength of the monofilaments were established (Figure). The monofilaments then exited the extrusion machine (the third oven) and passed through a series of five, numbered, 8-inch diameter rollers to an accumulator where the properties of the monofilaments were checked by the quality assurance auditor to see that they met specifications. Because the filaments had to be wound around the rollers by the operator before being fed onto the spools, the rollers were not guarded. The monofilaments were then attached to board-mounted spools which were filled according to orders. Depending on the time necessary to fill the spools (a doff), either one or two operators were present at each machine. If the doffs were short, two operators manned each extrusion machine, while longer doffs required only one operator.



On the day of the incident, the victim was the operator of an extrusion machine discharging 6-pound test monofilament fishing line. Since the doffs were sufficiently long, the victim was the only operator on the machine. The specifications had been checked by the quality assurance auditor on the accumulator and the line was being fed to the board-mounted spools. The event was unwitnessed; however, monofilament material wrapped around the end of roller #4 suggests that one of the strands broke as it was discharged from the extrusion machine. The material then began to wrap around the end of the roller. In an attempt to clear the material from the roller, the victim's right arm became entangled between rollers #4 and #5 and the victim's head was pulled between the rollers. An operator of a nearby machine looked toward the victim's machine to see the victim come to an upright position, then fall over. The operator called to the shift supervisor then ran to the victim. When the two men arrived at the victim's machine they found the victim lying on the floor with no vital signs and bleeding from the head. While the operator tried to control the bleeding, the supervisor called the emergency medical squad (EMS) from a plant office. Cardiopulmonary resuscitation (CPR) was not initiated due to the victim's head injuries. The EMS transported the victim to the hospital where he was pronounced dead by the attending physician.

CAUSE OF DEATH

The attending physician listed the cause of death as major head trauma.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should equip machines with safety trip controls and guard machine rollers that might be inadvertently contacted by workers.

Discussion: Although operators must access the extrusion machine rollers to thread the monofilaments around them, the perimeter of the roller area could be equipped with a safety trip device such as pressure-sensitive body bars. A pressure sensitive body bar, when depressed, would deactivate the machine. If the machine operator or any worker would trip, lose their balance, or be drawn into the machine, applying pressure to the bar would stop the operation. The positioning of the bar would be critical. Additionally, the rollers could be fitted with a guard that would be lifted when access was necessary, then lowered to prevent inadvertent contact by persons working, standing, or passing near the machines.

Recommendation #2: Instruct employees not to attempt to clear fouled material from rotating rollers.

Discussion: Because of the ever-present danger of entanglement when working near moving machinery components, workers should be instructed not to attempt to clear fouled materials, or access in any way, rotating rollers. Clean-up or maintenance operations should only be performed when the rollers are stationary. Since the incident, machine operators have been instructed to shut the extrusion machine down before attempting to access the rollers or other moving machinery components.

Recommendation #3: Employers should evaluate means to prevent broken monofilaments from building up on machine rollers.

Discussion: Because the rollers must be accessed by the machine operator(s), the employer has not been able to develop a functional permanent guard for the rollers. Since the incident, the employer has evaluated different systems to prevent broken monofilaments from building up on the extrusion machine rollers. An aspirator was developed in the plant machine shop that would direct air from a 40-horsepower blower down over the rollers. If a monofilament broke, it would be directed away from the rollers by the air until it could be re-threaded through the rollers. The aspirator was being tested with a 10-horsepower blower at the time of the investigation and seemed functional.

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Last Reviewed: November 18, 2015

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