

FATALITY INVESTIGATION REPORT

INCIDENT HIGHLIGHTS



DATE:
August 23, 2018



TIME:
2:45 p.m.



VICTIM:
23-year-old male Rubber
Cutter



INDUSTRY/NAICS CODE:
Manufacturing/32



EMPLOYER:
Custom rubber
compounding and
processing



SAFETY & TRAINING:
Safety meetings & training
facilitated by employer

SCENE:
Festoon (cooling line)



LOCATION:
Oregon



EVENT TYPE:
Caught in or between



Rubber equipment operator died after his head was caught between bars of operating machinery

REPORT#: 2018-29-1

REPORT DATE: June 2019

SUMMARY

On August 23, 2018, a 23-year-old male Caucasian rubber cutter was found caught between two bars of a festoon rubber processing line (cooling line). The event was unwitnessed; however, circumstances suggested that the employee entered the festoon area to retrieve and redirect a rubber strip on a cooling bar that had passed the point where it should have fed onto a conveyor. It is believed that the worker raised his head between the moving cooling bars, and that the bars then forced his head against a structural support for an electrical panel. He was pronounced dead at the scene. ([Full report begins on p. 3](#))

CONTRIBUTING FACTORS

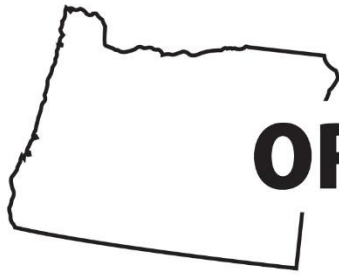
Key contributing factors identified in this investigation include:

- Inadequate equipment safeguard
- Inadequate lockout/tagout program and training
- Inadequate hazard assessment and knowledge of safeguarding equipment
- Inadequate training and assessing workplace hazards

RECOMMENDATIONS

Oregon Fatality Assessment and Control Evaluation (OR-FACE) investigators concluded that to help prevent similar occurrences, employers should:

- Safeguard machinery to protect machine operators and others who work in the area from hazards.
- Implement, enforce, and assess “control of hazardous energy (lockout/tagout)” procedures for machines, equipment and processes where unexpected energization or start-up could cause harm to personnel.
- Establish a safety committee that meets the requirements of Oregon Occupational Safety and Health Administration (OSHA).
- Confirm industry best practices for specialty equipment, and notify equipment manufacturers of equipment hazards identified in hazard assessments.



OREGON

State **FACE** Program

Fatality Assessment & Control Evaluation

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Oregon Fatality Assessment and Control Evaluation (FACE) Program

The Oregon Fatality Assessment and Control Evaluation (OR-FACE) Program is a project of the Oregon Institute of Occupational Health Sciences at Oregon Health & Science University (OHSU). OR-FACE is supported by a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH) (grant #U600H008472) through the Occupational Public Health Program (OPHP) of the Public Health Division of the Oregon Health Authority. OR-FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.

OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.



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INTRODUCTION

On August 23, 2018, a 23-year-old rubber cutter was killed when he attempted to retrieve a rubber strip on the cooling line (Festoon, see photos 1 and 2) that had passed the point where it should have been fed onto a conveyor. He raised his head between two horizontal bars, and as the line began to move, it forced his head against the electrical panel support. OR-FACE received notification of the incident from Oregon OSHA (OR-OSHA). This investigation report is based on OR-FACE site visit with an OR-OSHA investigator, review of OR-OSHA investigation documents, follow-up discussions with the OR-OSHA investigator, and best practices research.

BACKGROUND

The rubber industry uses powerful machinery that has the potential to cause fatalities and serious injuries. Serious incidents may take place during repairs or to clear blockages, if proper safety procedures are not followed, including de-energizing the equipment. Mechanical hazards include rollers, conveyors, rotating equipment, power feeders, and cutting blades.

EMPLOYERS

The decedent worked at a custom rubber compounding and mixing facility. The corporation has been in business for approximately 50 years and employed a total of 79 employees at the time of the incident, including full-time and part-time employees. There were 35 employees working on site on the day of the incident.

WRITTEN SAFETY PROGRAMS and TRAINING

The company safety programs included monthly safety and environmental meetings with documented minutes. There was no indication of quarterly safety inspections. A training guide was created for each position, e.g., rubber cutter, chemical compounder, mixer operator. The guide outlined purpose and scope, responsibility, and safety. Items listed under "safety" included emergency response, personal protective equipment, lifting, and forklift operation. The Production Supervisor maintains the training guide with employee signature obtained once trained. A written Control of Hazardous Energy (Lockout/Tagout) Procedure contained required regulatory elements with photographs of equipment, procedure, and energy source. The Company's Lockout/Tagout procedure listed "authorized" personnel, who were management/supervisors, and maintenance staff (millwright, welder/fabricator). As defined in the OSHA standard and stated in the procedure, "authorized" personnel, were to be trained in the "recognition of applicable hazardous energy sources, type and magnitude of energy available...and the methods and means necessary for energy isolation and control. In accordance with the OSHA standard, the company procedure defined "affected" employees as all employees other than authorized employees utilizing the lockout/tagout procedure and that they shall be instructed in the purpose and use..." Operators, such as the decedent, were not included in the list of "authorized" personnel, therefore, not trained to de-energize or lockout equipment.

WORKER INFORMATION

The 23-year-old decedent had two years of experience working for this employer. Signed documents and interviews indicate that the employee was trained on different processes and listed as fully competent as a chemical compounder, rubber cutter, mixer, and lacer.

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INCIDENT SCENE

On the day of the incident, the worker began his shift at 7:00 am. He was assigned to operate the cutter machine. Cutting is the initial station for that production line followed by the mixer station, and the drop and strip mill. During the process, heat is created, and the product must be cooled before preparing it for shipment. As the rubber strip leaves the process, it is laced onto the festoon for cooling. The “Rubber Lacer” operates the festoon and assures the strip is conveyed to the shipping area where it is placed onto pallets for shipment. The festoon (see Photos 1 and 2) was comprised of approximately 90, 1.5-inch diameter rods spaced approximately 4 inches apart, and approximately 59.5 inches above the floor. These rods move parallel to the floor and reportedly were programmed to travel four inches every five seconds. The speed of the festoon allows segments of the strip to drop between bars in a serpentine action. As the laced rubber strips travel on the festoon, they pass the fans that blow air to cool the strip. The Operator/Rubber Lacer is expected to observe the rubber strips as they begin to rotate on the festoon. Once the strip starts on the festoon the operator then moves to the other side of the machine to ensure that the strip is directed onto the off-loading conveyor for transport to the packaging/shipping area.

Throughout the day, between batches, the decedent was observed walking through the process area asking other equipment operators if they needed help. At approximately 2:45 pm, the Rubber Lacer asked for assistance with the batch travelling on the festoon. Specifically, the decedent was asked to assure that the lead rubber strip was directed to the conveyor belt that feeds the product to the shipping area. The Rubber Lacer was waiting at the shipping area to observe the strip arrive on the conveyor. When it didn't arrive as expected, he called out to the worker. After receiving no response, the operator went around to the other side of the machine to look for the worker and found him caught between two rods, unresponsive.

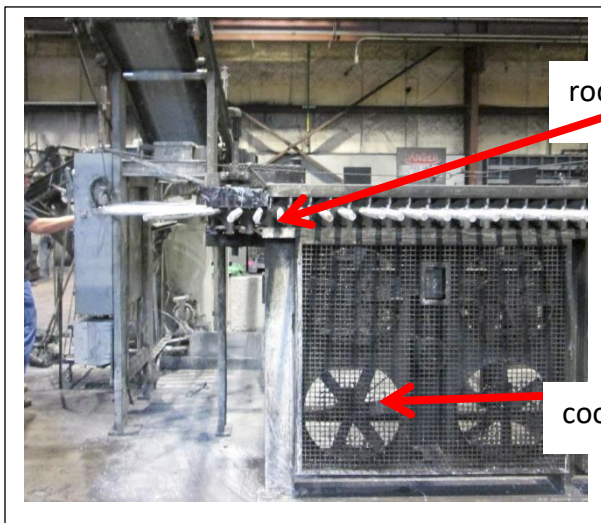


Photo 1. Unguarded festoon (cooling line) (Photo courtesy of OR-OSHA).

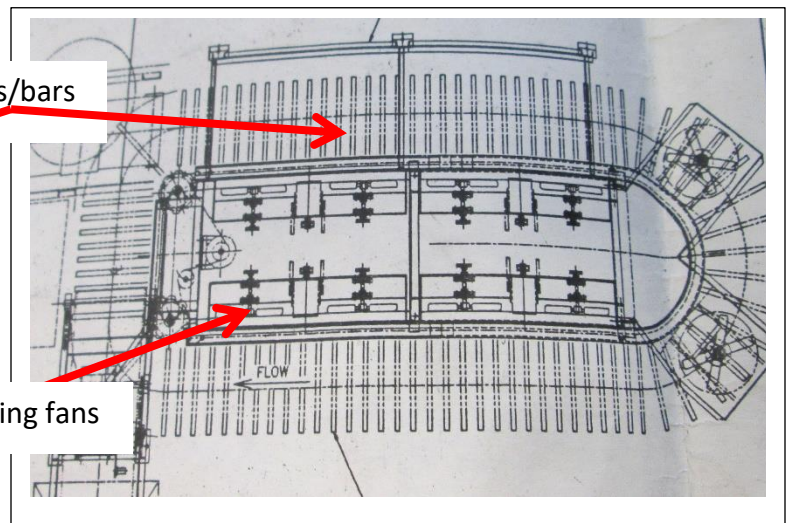


Photo 2: Schematic of festoon (cooling line) (Photo courtesy of OR-OSHA).

WEATHER

The weather was not considered to be a factor in the incident as it occurred indoors.

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INVESTIGATION

There were no witnesses to the incident (the decedent was not within visual sight of the Rubber Lacer, who was at the other end of the festoon), and no one observed the worker entering the unguarded festoon area. It is speculated that the lead strip had passed the point where it would normally be fed to the conveyor and had made its way around the corner, where the worker likely entered the festoon. As the bars rotate around the corner of its elliptical path, the bars separate (see Photos 2 and 3) at the outside end. It appeared that the worker raised his head between two bars, and when the equipment began to rotate, his neck was caught between the bars, forcing his head against the control panel support.

Upon finding the worker, the operator pressed the emergency button at the control panel to shut the system down, indicating that the machine had been energized. Moreover, records indicated that none of the operators were “authorized” to lockout any equipment. Some were trained as “affected” (awareness of LOTO program but not trained to de-energize or lock equipment) employees.

There were other similar festoons on site. None were safeguarded to prevent entry into danger zones or contact with rotating bars/rods. Employees were allowed to reach into the machine to make minor alterations while operating.

One of the festoons is situated near the locker room and employees walked passed rotating rods several times daily. According to the employer investigation report, unguarded festoons are common throughout the rubber industry. It is unknown if festoon manufacturers recommended guards/barriers or notified buyers of potential entanglement hazards. After the incident, the employer halted production until physical guards were installed (see Photos 4 and 5).

In two safety committee meetings preceding the incident the following action item, related to a new festoon line being assembled, was listed: “call for OSHA consultation after new production line is installed. Check safety systems and ask questions about lockout tagout procedures.”

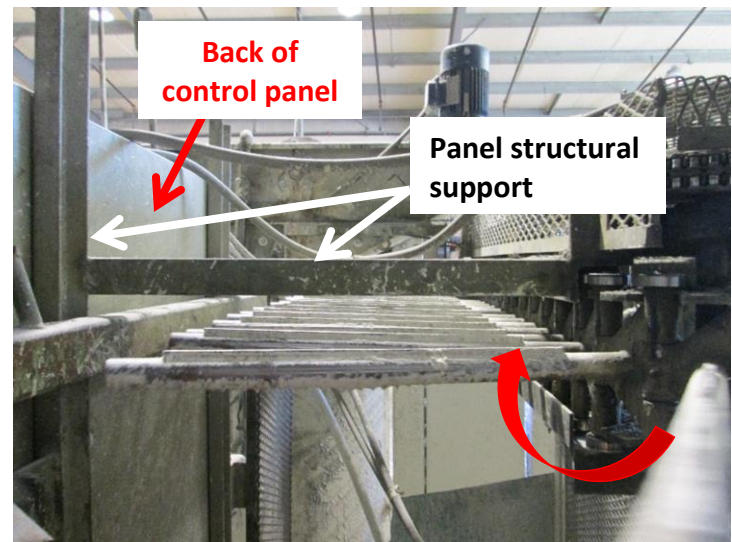


Photo 3. Festoon corner section; note the distance between two bars (Photo courtesy of OR-OSHA).

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Photo 4. Installed guard at festoon line
(Photo courtesy of OR-OSHA).



Photo 5. Installed guard with serpentine rubber strip visible (Photo courtesy of OR-OSHA).

CAUSE OF DEATH

According to Oregon Vital Records data, the cause of death was neck injury.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in the injury or fatality. OR-FACE investigators identified the following factors that may have contributed to this incident:

- Inadequate equipment safeguard, allowing entry into area of rotating equipment.
- Inadequate lockout/tagout program and training. The program and training emphasized maintenance and servicing and did not consider operator actions that would require de-energizing to prevent contact with/avoid inadvertent movement of equipment components.
- Inadequate hazard assessment and knowledge of safeguarding equipment, and based on a perception that the festoon was not hazardous, or as hazardous as other equipment.
- Inadequate training and communication regarding hazards. There were no records of regular hazard inspections nor training on identifying hazards.

RECOMMENDATIONS/DISCUSSION

- **Recommendation #1: Safeguard machinery to protect machine operators and others who work in the area from hazards. The safeguard should prevent employees from having any part of their body in the danger zone during the machine operating cycle.**

Discussion: Rubber manufacturing machinery are comprised of rolling machines, extruders, mixing and cutting. The employer's primary focus prior to the fatality was safeguards for these equipment, which they may have believed to be more hazardous. However, any machine part, function, or process that may cause injury must be safeguarded. This includes slow moving machine parts like the cooling festoon.

OSHA's publication, "Basics of Machine Guarding" (see references), states that equipment safeguards must be secure such that workers cannot easily remove or tamper with the safeguard. The physical barriers (see Photos 4 and 5) installed by the employer after the incident appeared to be secure and fixed. However, such barriers should not create interference. If the guard impedes the worker from completing his task efficiently and comfortably the guard will likely be overridden or disregarded. It was not determined in the investigation how often the rubber strip required redirection from the festoon line to the off-loading conveyor. When doing so, the safeguard must prevent hands, arms, and any other part of a worker's body from making contact with hazardous moving parts. A tool to reach over the guards to capture and direct the strip may be a consideration. However, this action should not create new hazards.

Other possible safeguards include engineered systems such as light curtains or interlocks. When an interlocked guard is opened or removed, the tripping mechanism and/or power automatically shuts off or disengages, the moving parts of the machine are stopped, and the machine cannot cycle or be started until the guard is back in place. An interlocked guard may use electrical, mechanical, hydraulic, or pneumatic power or any combination of these. To be effective, all removable guards should be interlocked to prevent occupational injury hazards. Interlocks allow access to the machine for removing jams without time-consuming removal of the fixed guards.

- ***Recommendation #2: Implement, enforce and assess "control of hazardous energy (lockout/tagout)" procedures for machines, equipment and processes in which the unexpected energization or start-up could cause harm to personnel. These activities may include, adjusting inspecting, unjamming, set up, testing, troubleshoot, servicing and maintaining machines, equipment or processes.***

Discussion: Documents obtained in the investigation included the company's "Control of Hazardous Energy (Lockout/Tagout)" Program. Those employees trained as "authorized" according to the OSHA standard, were management and maintenance personnel. Operators were to be trained as "affected" (defined in the OSHA standard) employees, although, interview notes disclosed that some operators did not recall the training or when to initiate the lockout/tagout (LOTO) process. The decedent entered the danger zone to retrieve the lead strip. The lead strip had gone well past the offload conveyor, requiring adjustments to redirect the strip. Had there been a physical barrier in place around the festoon, this task would have required entry into the danger zone; this would have required controls to prevent inadvertent movement of machinery. In many cases LOTO is associated with maintenance and servicing equipment and relegated to maintenance personnel; however, if operators are required to enter danger zones, they must be included as "authorized" employees in the LOTO program. Tasks associated with operating the machinery, and not just maintenance or servicing positions, should be assessed to determine when LOTO procedures should be initiated.

- ***Recommendation #3: Establish a safety committee that meets the requirements of Oregon OSHA. Specifically include requirements of quarterly inspections to identify and mitigate hazards, and including representatives from all major activities.***

Discussion: Documentation of safety and environmental meetings were reviewed. These minutes were posted above the time clock as confirmed during interviews. According to Oregon OSHA, safety committees must have an equal number of employer-selected members and employee-elected (or volunteer) members and must include representatives from the major activities of the company. Based on the meeting minutes obtained, it did not appear that operators were represented on the committee. Additionally, according to interview responses, quarterly inspections may not have occurred. Critical to effective inspections by the safety committee is hazard identification training as required by Oregon OSHA and employee involvement in hazard mitigation. After the incident, the employer encouraged employees to report hazards. This particular action is one step in developing a foundation for a safe workplace. Refer to Oregon OSHA, “Foundations for safe workplace” and NIOSH “Elements of Effective Workplace and Policies for Improving Worker Health and Wellbeing” for guidance in sustaining a safety culture.

- **Recommendation #4: Confirm industry best practices for specialty equipment, notify equipment manufacturer of fatal hazards identified in hazard assessment.**

Discussion: Several references in the investigation documents, indicated that unguarded festoons were common industry practice. OR-FACE contacted the employer requesting information about the festoon cooling line manufacturer, but no response was received; therefore, OR-FACE was unable to contact the manufacturer. Online research of rubber compounding equipment manufacturers revealed only international companies. This only emphasizes the importance of buyers/users to assess safeguards on machinery especially those manufactured internationally.

OR-FACE was unable to confirm from either American Chemical Society (ACS) – Rubber Division, or Association of Rubber Products Manufacturers (ARPM) whether festoons/cooling lines without safeguards is an industry practice. Association of Rubber Products Manufacturers replied that a majority of their members were molders not mixers. It is the intent of OR-FACE to forward this report to the industry and trade associations mentioned above.

DISCLAIMER

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REFERENCES

Basics of Machine Guarding, US Department of Labor, OSHA
https://www.osha.gov/Publications/Mach_SafeGuard/chapt1.html

Elements of Effective Workplace and Policies for Improving Worker Health and Wellbeing – CDC National Institute for Occupational Safety & Health
<https://www.cdc.gov/niosh/twh/essentials.html>

Foundations of a safe workplace—Oregon OSHA
<https://osha.oregon.gov/OSHApubs/4755.pdf>



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Lockout/Tagout, Oregon OSHA's guide to controlling hazardous energy -Oregon OSHA
<https://osha.oregon.gov/OSHAPubs/3326.pdf>

Machine guarding eTool--US Department of Labor, OSHA
<https://www.osha.gov/SLTC/etools/machineguarding/guards.html>

Oregon OSHA, Division 2, Subdivision O, Machinery and Machine Guarding (29 CFR 1910.211-1910.219); adopted by reference),
<https://osha.oregon.gov/OSHARules/div2/div2O.pdf>

Oregon OSHA, Division 1, 437-001-0765 Safety Committees and Safety Meetings
<https://osha.oregon.gov/OSHARules/div1/437-001-0765.pdf>

Safety committees and safety meetings for general industry and construction employers—Oregon OSHA
<https://osha.oregon.gov/OSHAPubs/0989.pdf>

US Department of Labor, OSHA "Machine Guarding Checklist"
https://www.osha.gov/Publications/Mach_SafeGuard/checklist.html

Weather Underground. <https://www.wunderground.com/history/>

Additional Resources:

"Introduction to rubber processing and safety issues" – Health and Safety Executive
<http://www.hse.gov.uk/rubber/introduction-to-rubber-processing.pdf>

"Guideline for safeguarding machinery and equipment" – WorkSafe BC, June 2008
<https://www.safemanitoba.com/Page%20Related%20Documents/uploads/guidelines/safeguardingmachineryequip.pdf>

INVESTIGATOR INFORMATION

This investigation was conducted by Illa Gilbert-Jones and Barbara L. Epstien from the OR-FACE Program. The report was reviewed and received input from Ryan Olson, PhD, Director, OR-FACE Program, and the OR-FACE Publications Review Panel.

ACKNOWLEDGEMENT

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