TO: Director, National Institute for Occupational Safety and Health

FROM: Iowa FACE Program

SUBJECT: Metal conveyor belt slides down incline crushing supervisor -- Iowa.

SUMMARY: A 35 year old supervisor from an out-of-state manufacturing company was killed while he was overseeing the installation of a heavy metal conveyor belt at a recycling plant. This conveyor system was designed to move recycled materials from ground level to a new elevated sorting line. Installation workers were assembling the metal conveyor belt at ground level and pulling it up a 30 degree incline using hand operated winches. When the conveyor belt reached the top of the incline, the workers proceeded to rearrange their winches to pull the belt around the top roller. To hold the conveyor belt in place while adjusting they attached a safety chain to a 2"x2" piece of angle iron which was welded temporarily to a 4"x4" angle iron sweep on the conveyor. They had repeated the same procedure earlier when the conveyor was in lower positions without problems.

However, at this time, because of jerky movements, the welded attachment point failed, and the entire conveyor belt immediately slid down the incline and bunched up on the ground level. The temporary weld was not able to withstand the added force from the heavy metal conveyor belt on the full length of the incline. The victim was standing on or walking over the conveyor at ground level when the weld failed. He was knocked down and dragged through a narrow space between the belt and the conveyor frame, causing extensive crush injuries to his truck and extremities. An ambulance was located across the street and arrived within two minutes, however due to the extent of his injuries, the man was dead on arrival at the local hospital.

RECOMMENDATIONS following our investigation were as follows:

Recommendation #1 *The manufacturer should establish a written procedure for safe installation and maintenance of conveyor belts, trying to identify dangerous times during the installation process.*

Recommendation #2 *The manufacturer should train all installation and maintenance workers to follow safe working procedures.*

INTRODUCTION

In August of 1995 a supervisor from an out-of-state manufacturing company was killed while overseeing the installation of a new conveyor belt for a recycling plant in Iowa. The Iowa FACE program became aware of the incident on August 23 from the State Medical Examiner's office, and two investigators from the Iowa FACE program conducted a site visit on Aug. 30 and took photographs of the conveyor system which was fully installed at that time. Other

sources of information included the Iowa Division of Labor, a local newspaper, and interviews with both out-of-state companies.

This accident involved three separate companies: the recycling plant, the conveyor manufacturer, and the installation company. The victim was working for the manufacturing company which manufactures several types of recycling equipment, including conveyors and material crushers. They have been in business for 20 years and have 80 employees at their out-of-state manufacturing location. The victim was one of three customer service technicians who were experienced in equipment installation and repair. He had been employed by the company for the past 13 years, having been in his current position for 3 years, and having supervised the installation of 10 similar conveyor belts.

The manufacturer had no written safety procedures in place for installation of the ground-feed conveyor belts, nor was there formal safety training associated with the installation. Each supervisor was trained on-the-job during several installations. This had been sufficient for many years without incident. One company executive stated he had not heard of this type of accident anywhere in the entire recycling industry. This was the company's first occupational fatality.

INVESTIGATION

This recycling plant was in the process of building a new elevated sorting line for recyclable materials. The sorting line was designed to be fed from the ground level by a heavy duty steel conveyor belt that rises at a 30 degree slope up a 44 foot long incline to the height of ~18 feet. The belt was 152 feet long and 5 feet wide and made of ¼ inch thick steel plate sections measuring 5 feet wide by 9 inches long. Each 9 inch plate is hinged to the adjacent plate, with the ends attached to a heavy chain with rollers. There was a 4"x4" angle iron sweep attached to the conveyor section every six feet along its length.

The plant had ordered the sorting line from a manufacturer, which had contracted another company to do the installation. The installation company had previous experience of similar installations. The victim was called to the recycling plant to oversee the assembly and installation of the conveyor belt, and instruct the installation company's crew of 8-10 men on site.

On the day of the accident 85 feet of the belt had been assembled and pulled up the incline with 2 portable 1½ ton chain hoists attached to nylon slings which were attached to the leading edge of the metal belt. The hoists allowed the belt to be pulled up 12 feet before they had to readjust their rigging to pull again. During readjusting the belt was held in place by a chain attached to the first 4"x4" sweep of the belt. The attachment point was a 2 inch long piece of 2"x2" angle iron which had a torched hole in one side for attachment of the chain. This angle iron piece was temporarily welded in the middle of the first 4"x4" angle iron sweep.

The crew proceeded as usual pulling the belt section by section up towards the top of the incline readjusting the rigging several times in the process. At the top they had to readjust their rigging again to pull the belt around the head roller and back down to the opposite direction. They attached the chain in the same fashion as before, but when they released their chain hoists

the stress on the small piece of 2"x2" angle iron was too great and it snapped off its welded attachment to the 4"x4" angle iron sweep and the entire belt rapidly slid down the incline and bunched up at the ground level.

The victim was apparently standing, kneeling, or walking across the belt when this happened and was dragged under a 4"x4" angle iron frame cross member located above the belt at ground level. The clearance from the belt to this cross member was 5 inches with one inch between the top of the sweep and the cross member. The force of the impact bent the 4x4 angle iron cross member backward and upward several inches. The victim suffered extensive crushing injuries to his extremities, pelvis, and internal organs. An ambulance was officed across the street and was at the site within 2 minutes, but the man was unresponsive and was dead on arrival at the local hospital.

There were no direct eyewitnesses who saw the victim just prior to the accident. It is assumed that he was standing on the belt checking its alignment while it was stationary during the rigging change. Company officials stated that it is a common practice to eyeball the installation from this position to assure proper alignment. All procedures of this installation were directed by the victim, including the creation of the 2x2 angle iron piece that failed. IOSH investigations observed no violations of safety procedures and issued no citations to any of the 3 companies involved in this incident.

Our on-site investigation took place several weeks after the accident. The belt had been completely installed but was not yet operational. We observed the 2 inch piece of 2x2 angle iron and saw the weld points that had failed. The weld was rough and incomplete; it appeared that the welding was done with excessive voltage burning through the metal and leaving only little solid welding to hold the piece. This may have been intentional because this piece was to be removed later and the sweep should remain smooth and clear of obstructions. The welding was strong enough to hold the belt in place during previous rigging, however, at this point the force was at it's greatest because the belt was pulled all the way up and there was no counter force from part of the belt being over the top roller. Slight slack in the rigging caused a jerking of the safety chain when the rigging was changed. The weak weld was the cause of the accident, however no citations were issued by IOSH, for there are no regulations concerning temporary welding of this type.

CAUSE OF DEATH

The cause of death from the county medical examiner's report was *"massive trauma to trunk and extremities due to accident".* There was no autopsy performed and all blood and fluid tests were negative.

RECOMMENDATIONS / DISCUSSION

Recommendation #1 *The manufacturer should establish a written procedure for safe*

installation and maintenance of conveyor belts, trying to identify dangerous times during the installation process.

Discussion: The installation process included using a temporarily welded attachment, which failed. A more reliable method should be developed. In addition the manufacturer should thoroughly analyze all hazards related to the installation and maintenance of their conveyer belts, and establish written safe procedures to avoid future accidents. This procedure should include safe methods for assembling the belt, pulling it up the incline, holding it securely in place at all times during installation, and avoiding crush points such as the frame cross member when possible.

The manufacturer in this case has lately developed an "installation kit" that consists of a special lead section of the belt that is designed only for installation. This section has solid anchors for winches and safety chains, designed to adequately hold the belt through the rigorous process of installation. In addition this company has included anti-rollback stops along the incline itself which act as a ratchet to stop any reverse movement of the belt anytime during installation or operation of the belt. They have also decided to install the 4x4 angle iron frame support after the belt is installed removing a possible crush point.

Recommendation #2 *The manufacturer should train all installation and maintenance workers to follow safe working procedures.*

Discussion: The installation supervisor and the crew were not adequately aware of the hazards related to the installation. The manufacturer should provide training for its own employees in the use of new safe installation methods. The manufacturer should also ensure that any other company possibly being contracted to do the installation also provides similar training to its employees and follows a safe installation procedure. This training should be documented and the manufacturer should ensure that the installation of any of their conveyors has a trained and qualified supervisor who has been trained in these safe installation procedures.

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Fatality Assessment
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Control Evaluation Program
(FACE)

The University of Iowa, in conjunction with Iowa Department of Public Health and National Institute for Occupational Safety and Health (NIOSH), is investigating the causes of work-related fatalities in the State of Iowa. FACE is a surveillance program that identifies all occupational fatalities, conducts in-depth, on-site investigations on specific types of fatalities, and makes recommendations for employers employees, farmers and others to help prevent similar fatal accidents in the future.

Iowa is a major farming state, and therefore the Iowa FACE Program deals with many occupational deaths on the farm. It is a very hazardous profession that claims hundreds of lives nationally every year. We publish detailed reports that are disseminated to agricultural leaders in Iowa to share our concern for the safety of farmers. To reach and effectively communicate with the agricultural community, which is at high risk of fatal injuries, is a worthy challenge in Iowa.

NIOSH funded state-based FACE Programs include: Alaska, California, Colorado, Georgia, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Wisconsin, and Wyoming.

Additional information regarding this report or the Iowa Face Program is available from:

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