

UNITED STATES  
DEPARTMENT OF LABOR  
MINE SAFETY AND HEALTH ADMINISTRATION

REPORT OF INVESTIGATION  
UNDERGROUND METAL MINE

(Zinc)

Fatal Fall of Person Accident  
July 29, 2007

Cowin & Company, Inc  
Contractor I.D. B84  
at  
Immel Mine  
East Tennessee Zinc Company, LLC  
Mascot, Knox County, TN  
Mine I.D. 40-00170

Investigators

Curtis G. Roth  
Supervisor Mine Safety and Health Inspector

Thomas G. Galbreath  
Mine Safety and Health Inspector

Richard A. Allwes, PE  
Civil Engineer

Ricky W. Boggs  
Mine Safety and Health Specialist

Thomas J. Morgan  
Mine Safety and Health Specialist

Originating Office  
Mine Safety and Health Administration  
Southeastern District  
135 Gemini Circle, Suite 212, Birmingham, AL 35209  
Michael A. Davis District Manager



## OVERVIEW

Daniel E. Frederick, contract miner/driller, age 29, was fatally injured on July 29, 2007, while working from the top of a shaft conveyance (cage) in the main shaft compartment. Frederick and a coworker were positioned on a beam removing concrete from steel shaft sets. One end of the beam broke loose and both men fell. They were wearing fall protection but Frederick's lanyard was not secured and he fell approximately 1,000 feet to the shaft bottom.

The accident occurred because management policies and controls failed to ensure that persons could safely work in the shaft where there was a danger of falling. The victim was wearing a full-body harness and a lanyard but the lanyard was not secured.

## GENERAL INFORMATION

Immel Mine, an underground zinc operation, owned and operated by East Tennessee Zinc Company, LLC (ETZ) was located in Mascot, Knox County, Tennessee. The principal operating official was Daniel Steinhoff, mining operations manager. The mine opened in 1964 and closed in 2001. ETZ took ownership of the mine in 2006. When the accident occurred, the mine was in a non-producing status and rehabilitation work was being performed underground. ETZ normally worked two 12-hour shifts per day, 7 days a week. Total employment was 77 persons.

Cowin & Company, Inc. (Cowin) located in Birmingham, Alabama, was contracted by ETZ to replace steel sets, concrete stabilization blocks, and shaft guides in the three compartment shaft at the mine. The principal operating official was Herb Gibson, project engineer. Cowin normally worked two 12-hour shifts per day, 7 days a week and employed 12 persons at the mine.

The last regular inspection at this operation was completed on March 19, 2007.

## DESCRIPTION OF ACCIDENT

On July 28, 2007, Daniel Frederick (victim) reported to work at 7:00 P.M., his normal starting time. Five Cowin employees, including Frederick, attended a safety meeting on the surface while the ETZ miners rode a small secondary cage down the shaft. About 7:30 P.M., three Cowin employees, Frederick; Joey Vinson, supervisor; and John Tucker, driller/miner; rode the small cage down the shaft to the 624 foot level and stepped to the top of the main service (large) cage to begin removing steel support beams in the shaft.

The work of replacing steel beams progressed normally until approximately 12:00 A.M. on July 29, 2007. At that time Frederick was working on one side of the shaft and Tucker on the other side. Tucker asked Frederick for help on his side of the cage. Frederick unhooked his lanyard and moved to assist Tucker who was kneeling on an I-beam. Frederick stepped onto the beam and picked up a pneumatic chipper to break a concrete stabilization block around the shaft steel. Tucker held the concrete to keep it from falling down the shaft.

As Frederick began chipping the concrete, one end of the beam that they were standing on dislodged from the connection point causing both men to fall. Frederick and Tucker were wearing full-body harnesses with lanyards but Frederick's lanyard was not secured and he fell approximately 1,000 feet to the bottom of the shaft. Tucker's lanyard was secured to a rope sling that limited the distance he fell. He was pulled to the top of the cage and was uninjured.

Mine rescue and emergency medical personnel were called, the victim was pronounced dead by the Knox County Coroner. Death was attributed to multiple blunt force trauma.

## **INVESTIGATION OF THE ACCIDENT**

On the day of the accident, the Mine Safety and Health Administration (MSHA) was notified at 12:11 A.M., by a telephone call from William Bowen, topman for Cowin, to the National Call Center. Wyatt Andrews, assistant district manager, was notified and an investigation was started the same day. An order was issued pursuant to section 103(k) of the Mine Act to ensure the safety of the miners.

MSHA's accident investigators team traveled to the mine, made a physical inspection of the accident scene, interviewed employees, and reviewed documents, conditions and work procedures relevant to the accident. MSHA conducted the investigation with the assistance of mine and contractor management and employees.

## **DISCUSSION**

### **Location of Accident**

The accident occurred in the main shaft compartment approximately 624 feet below the collar of the shaft.

### **Production Shaft Layout & Structure**

The production shaft was circular, unlined, 23 feet in diameter, and 1,642 feet deep. The shaft consisted of three main compartments with one conveyance in each compartment. An ore skip, a small personnel cage, and a larger service and personnel cage were in the compartments. (Appendix B, Figure 1 & 2). Three auxiliary compartments, adjacent to the three main compartments, were used for mine services – compressed air, water, and electricity.

The main cage served as the counterweight during operation of the skip to transport ore from the production levels to the surface. The skip had a capacity of approximately 14 tons.

The steel sets in the shaft were on 8-foot vertical centers and the bearing beams were on 96-foot vertical centers. The bearing beams supported the dead weight of the steel sets and were anchored into the rock of the shaft wall. Concrete blocks were cast between the shaft wall and corners of the steel sets to stabilize each steel set and to prevent lateral movement during travel of the skip and cages.

These stabilizing blocks encapsulated, to different degrees, the corner of each steel set. The steel sets consisted of W-6x25 beams tied vertically with L-6x6x $\frac{1}{2}$  corner studdles and L-3 $\frac{1}{2}$ x3 $\frac{1}{2}$ x $\frac{1}{2}$  interior studdles. A studdle is a vertical angle shaped member of a steel shaft set. The sets are placed at each corner and at the intersection of the dividers and the wallplates. The studdles provide the means for connecting the beams together at their ends and support the weight of the steel sets. The studdles act as continuous hangers (tension members) that are supported (suspended) every 96 feet by bearing beams anchored into recesses cut into the rock of the shaft wall.

Nine  $\frac{3}{4}$ -inch A325 bolts were used to connect the steel sets at each of the four corner studdles. Four of these bolts were used to connect each leg of the studdle to the flange of each adjoining steel set beam (A1-B1 and A1-C1). The one remaining bolt was used during initial erection of the steel sets to connect the flange of an abutting beam (A1) to a clip angle that was riveted to each end of the B1 and C1 beams.

The rehabilitation of the shaft consisted of replacing all steel sets, studdles, clip angles, guides, and concrete stabilization blocks from approximately 100 to 700 feet below the shaft collar. The steel and guides in this location were being replaced because corrosion caused significant section loss. The  $\frac{3}{4}$ -inch A325 bolts used for connecting the steel sets and the single  $\frac{3}{4}$ -inch A325 bolts encapsulated in the concrete stabilization blocks were corroded to varying degrees.

The work was being performed from the top of the main cage that measured 16 feet by 8  $\frac{1}{2}$  feet. From the long dimension of the cage, the maximum distance from the cage's edge to the shaft wall was approximately 3  $\frac{1}{2}$  feet. The distance from the edge of the cage to the A1 beam was approximately 1 foot. There was no railing around the periphery of the top of the shaft cage.

As part of the rehabilitation work, the corner studdles were removed before the concrete stabilization blocks were removed. As a result of removing the eight bolts attaching the studdle to the steel set, a single  $\frac{3}{4}$ -inch bolt remained between A1 and C1. This bolt was encapsulated in the concrete stabilization blocks. Due to this encapsulation, the work crew could not see the bolt to verify its structural integrity or existence.

As a general practice, persons working in the shaft would stand or kneel on top of the A1, B1, and C1 beams to drill, chip, and remove the concrete blocks. These tasks could not physically be performed while persons were positioned on top of the cage. Vertical holes needed to be drilled into the concrete blocks, not from an angle, so lifting lugs could be installed. The lifting lugs were also installed while persons were positioned on the A1, B1, and C1 beams.

### **Fall Protection**

At the time of the accident, Tucker, Vinson, and Frederick were each wearing a full-body harness (Miller Revolution) and a Miller 6-foot shock-absorbing lanyard, with a large D ring. The harnesses and lanyards were inspected and found to be free of defects. Frederick's lanyard was not secured at the time of the accident.

### **Training and Experience**

Daniel Frederick had 3 years experience at various mining operations. He had worked 22 weeks and 2 days at this mine, 8 weeks for ETZ and 14 weeks and 5 days for Cowin. He had received training in accordance with 30 CFR, Part 48.

John Tucker had 3 years, 6 months experience at various mining operations. He had worked at this site for Cowin for 16 weeks. He had received training in accordance with 30 CFR, Part 48 with the exception of not being hazard trained at this site. A non-contributory violation was issued.

Joey Vinson had 12 years mining experience at various sites with Cowin. He had worked at this site for Cowin for 16 weeks. He had received training in accordance with 30 CFR, Part 48.

## **ROOT CAUSE ANALYSIS**

A root cause analysis was conducted and the following causal factors were identified:

Causal Factor: Management policies and controls were inadequate and failed to ensure that persons could safely work at elevated positions where there was a danger of falling. Management failed to conduct an assessment of the risk when performing these tasks and had not identified procedures to ensure the work could be completed safely.

Corrective Action: Management should establish policies and controls to ensure that persons can safely rehabilitate the shaft while working from the top of the cage in the shaft. Before beginning work, possible risks should be discussed and procedures should be established to safely complete the task.

Causal Factor: Management policies and work procedures failed to ensure that fall protection was properly used by persons working where there was a danger of falling.

Corrective Action: Management should establish policies and procedures that ensure fall protection is used continuously by all persons working where there is a danger of falling. Management should evaluate the use of retractable lanyard mechanisms that enable users to change positions without unfastening and reconnecting the lanyard. Management should monitor the work practices of persons working at elevated locations.

## CONCLUSION

The accident occurred because management policies and controls failed to ensure that persons could safely work in the shaft where there was a danger of falling. The victim was wearing a lanyard but it was not secured.

## ENFORCEMENT ACTIONS

### East Tennessee Zinc Company, LLC

Order No. 6123899 was issued on July 29, 2007, under the provisions of Section 103 (k) of the Mine Act:

A fatal accident occurred at this operation on July 29, 2007, when an employee of an independent contractor, Cowin & Company, Inc., ID No. B84, fell from the top of the large cage located in the main shaft. This order is issued to assure the safety of all persons at this operation. It prohibits all activity in the main shaft and all underground areas until MSHA has determined that it is safe to resume normal mining operations in the area. The mine operator shall obtain prior approval from an authorized representative for all actions to recover and/or restore operations to the effected area.

This order was terminated on August 8, 2007, after conditions that contributed to the accident no longer existed.

**Cowin & Company, Inc.**

Order No. 7775346 was issued on September 10, 2007, under the provisions of Section 104(d)(1) of the Mine Act for a violation of 30 CFR, 56.15005:

A fatal accident occurred at this mine on July 29, 2007, when a contract miner fell while performing repairs in the shaft. The victim was positioned on a shaft support beam when it broke free. Although the victim was wearing a fall protection harness, his safety line was not secured and he fell 1,000 feet to the shaft bottom. The contractor foreman was present and the contractor's failure to ensure that the miner's safety line was secured constituted more than ordinary negligence and was an unwarrantable failure to comply with a mandatory safety standard.

This citation was terminated on September 12, 2007. Management established a written procedure and re-instructed all persons regarding tie off procedures when working at elevated locations. Management will monitor the work practices of persons working at elevated locations.

Approved by: \_\_\_\_\_

Michael A. Davis  
District Manager

Date: \_\_\_\_\_

## APPENDICES

- A. Persons Participating in the Investigation
- B. Shaft Drawings, Top and Side Views
- C. Victim Data Sheet

## APPENDIX A

### Persons Participating in the Investigation

#### East Tennessee Zinc Company, LLC

Nathan W. Steele	underground manager
Dennis J. Hillman	health and security manager
Daniel J. Steinhoff	mining operations manager

#### Cowin and Company, INC

John D. Moore	vice president, safety and human resource
Herbert C. Gibson Jr.	chief engineer

#### Mine Safety and Health Administration

Curtis G. Roth	supervisory mine safety and health inspector
Thomas G. Galbreath	mine safety and health inspector
Richard A. Allwes, PE	civil engineer
Ricky W. Boggs	mine safety and health specialist
Thomas J. Morgan	mine safety and health specialist

APPENDIX B  
Figure 1

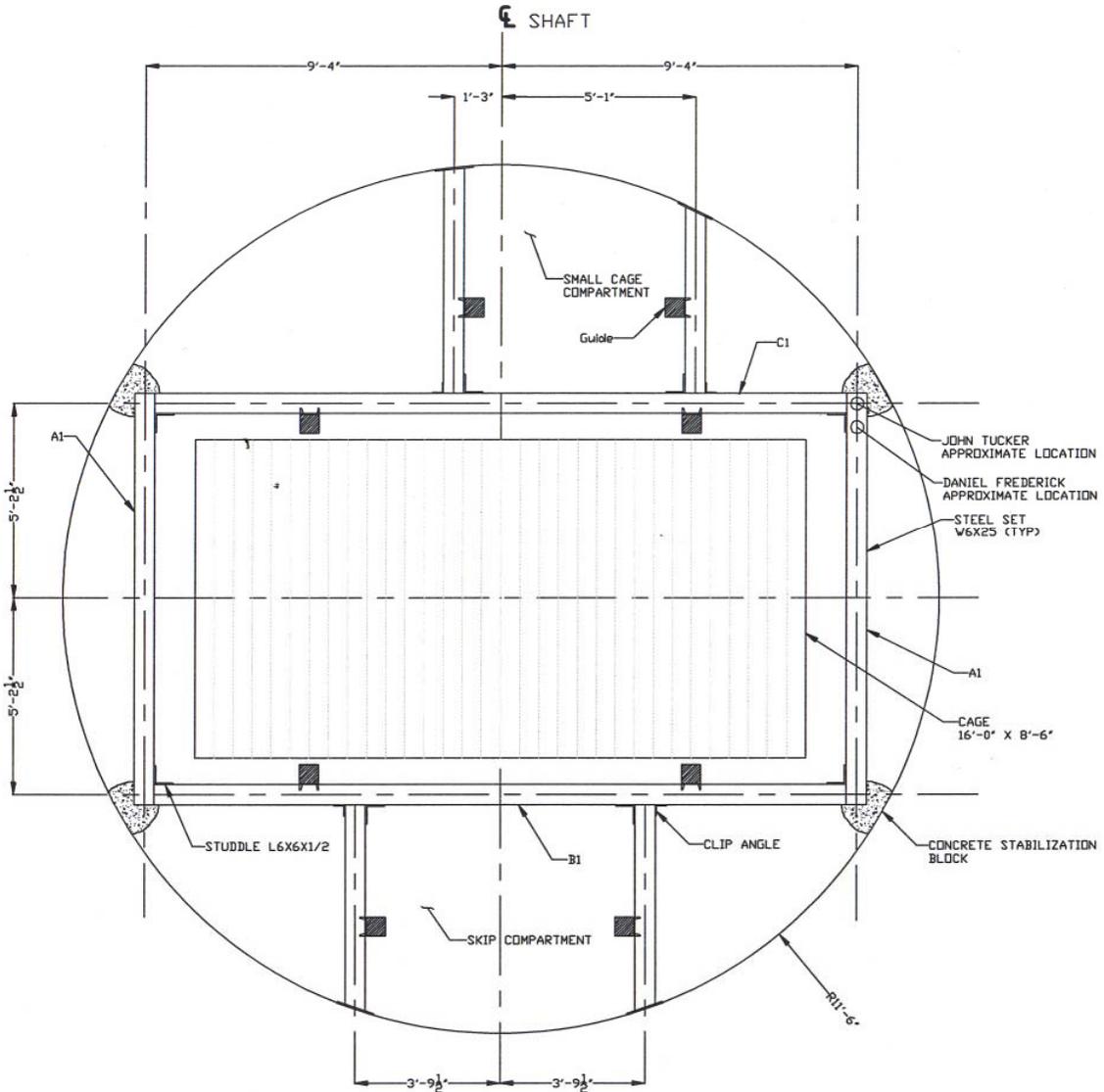
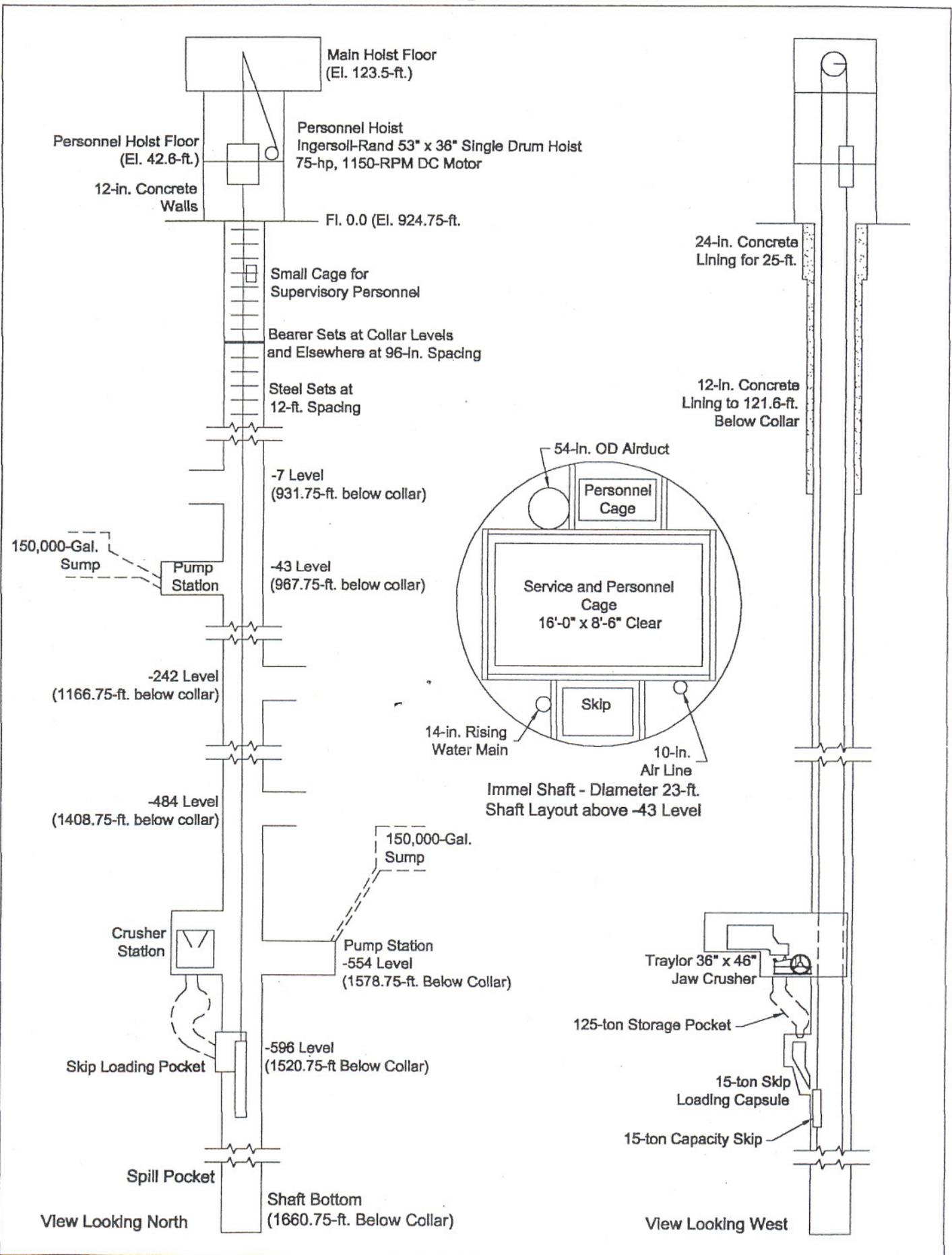


Figure 1. - Steel-Set Layout and Locations of Accident Victims at Immel Mine Production Shaft, 642 Feet Below the Collar.

# Section Through Immel Shaft



APPENDIX C

Accident Investigation Data - Victim Information

U.S. Department of Labor  
Mine Safety and Health Administration



Event Number: 0 9 3 6 0 7 1

Victim Information: 1

1. Name of Injured/ill Employee: <i>Daniel M. Frederick</i>		2. Sex <i>M</i>	3. Victim's Age <i>29</i>	4. Last Four Digits of SSN:	5. Degree of Injury: <i>01 Fatal</i>										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death: <i>a. Date: 07/29/2007 b. Time: 12:08</i>				7. Date and Time Started: <i>a. Date: 07/28/2007 b. Time: 7:00</i>											
8. Regular Job Title: <i>080 Shaft Miner Driller</i>		9. Work Activity when Injured: <i>098 Replacing steel shaft sets</i>			10. Was this work activity part of regular job? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>										
11. Experience a. This Work Activity:	Years <i>0</i>	Weeks <i>14</i>	Days <i>5</i>	b. Regular Job Title:	Years <i>0</i>	Weeks <i>14</i>	Days <i>5</i>	c. This Mine:	Years <i>0</i>	Weeks <i>22</i>	Days <i>2</i>	d. Total Mining:	Years <i>3</i>	Weeks <i>0</i>	Days <i>0</i>
12. What Directly Inflicted Injury or Illness? <i>084 Fall 1000 feet to shaft bottom</i>				13. Nature of Injury or Illness: <i>370 Blunt force trauma</i>											
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (if different from production operator) <i>Cowin &amp; Company, Inc.</i>			Independent Contractor ID: (if applicable) <i>B84</i>												
16. On-site Emergency Medical Treatment: Not Applicable: <input checked="" type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)			18. Union Affiliation of Victim:												

Victim Information:

1. Name of Injured/ill Employee:		2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started:											
8. Regular Job Title:		9. Work Activity when Injured:			10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input type="checkbox"/>										
11. Experience a. This Work Activity:	Years	Weeks	Days	b. Regular Job Title:	Years	Weeks	Days	c. This Mine:	Years	Weeks	Days	d. Total Mining:	Years	Weeks	Days
12. What Directly Inflicted Injury or Illness?				13. Nature of Injury or Illness:											
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
15. Company of Employment: (if different from production operator)			Independent Contractor ID: (if applicable)												
16. On-site Emergency Medical Treatment: Not Applicable: <input type="checkbox"/> First-Aid: <input type="checkbox"/> CPR: <input type="checkbox"/> EMT: <input type="checkbox"/> Medical Professional: <input type="checkbox"/> None: <input type="checkbox"/>															
17. Part 50 Document Control Number: (form 7000-1)			18. Union Affiliation of Victim:												

Victim Information:

1. Name of Injured/ill Employee:		2. Sex	3. Victim's Age	4. Last Four Digits of SSN:	5. Degree of Injury:										
6. Date(MM/DD/YY) and Time(24 Hr.) Of Death:				7. Date and Time Started:											
8. Regular Job Title:		9. Work Activity when Injured:			10. Was this work activity part of regular job? Yes <input type="checkbox"/> No <input type="checkbox"/>										
11. Experience a. This Work Activity:	Years	Weeks	Days	b. Regular Job Title:	Years	Weeks	Days	c. This Mine:	Years	Weeks	Days	d. Total Mining:	Years	Weeks	Days
12. What Directly Inflicted Injury or Illness?				13. Nature of Injury or Illness:											
14. Training Deficiencies: Hazard: <input type="checkbox"/> New/Newly-Employed Experienced Miner: <input type="checkbox"/> Annual: <input type="checkbox"/> Task: <input type="checkbox"/>															
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17. Part 50 Document Control Number: (form 7000-1)			18. Union Affiliation of Victim:												