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Remote Controlled Continuous Mining Machine Fatal Accident Analysis Report

Of

Victim's Physical Location With Respect to the Machine

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## Remote Controlled Continuous Mining Machine Fatal Accident Analysis Report Victim's Physical Location With Respect to the Machine

### Scope

An analysis was made of the thirty-eight (39) remote control-related fatal accidents that have occurred since October 1984. The analysis does not include roof fall fatalities. The analysis identified the work function being performed, whether or not the victim was the operator of the machine, and the physical location of the victim with respect to the machine. This report consists of a short summary of the 39 accidents, conclusions, and Figure 1, which summarizes the analysis and shows the physical location of the victims with respect to the mining machine.

### Accident Summary

1. *Alabama By-Products Corporation, Segco No. 1 Mine*, Walkersburg, Walker Co., AL, 10/15/1984 – The operator was pinched between a rigid trailing cable hanger at the right rear corner of the machine and the rib while tramming a continuous miner to a new location (place changing). The operator was operating the machine in an unsafe location (pinch point area). There were no eyewitnesses to the accident. The tethered remote control unit was found to have defective tram levers that would not spring return to the center position. The rigid trailing cable hanger was added by the mine to replace a flexible hanger. Mine personnel had not been instructed to reposition the hanger to allow maximum clearance between the hanger and rib when additional clearance was necessary to assure a safe location. Note: This accident was inadvertently omitted in earlier revisions of this report.
2. *Unicorn Mining, Inc., Unicorn Mine #2*, Bledsoe, Leslie Co., KY, 6/22/1988 – An operator's helper was crushed between the boom and the rib on the right side of the continuous mining machine while it was being trammed (place changing). Safe work practices were not being followed. The miner operator and the operator's helper failed to maintain communication and the miner helper was positioned at a pinch point against the rib when the machine was being moved. Note: This accident was inadvertently omitted in earlier revisions of this report.
3. *Pontiki Coal Corp, Pilgrim*, Martin Co., KY, 12/12/1988 - The operator was pinched between the right rear corner of the machine and the rib while tramming (setting over) a continuous miner. The operator was operating the machine in an unsafe location (pinch point area). There were no eyewitnesses to the accident and no safety features on the remote control could be identified as a factor in this accident.

4. *Bullion Hollow Mining*, Pardee, Wise Co., VA, 2/1/1990 - The operator was pinched between the right rear corner of the machine and the rib while tramming (place changing) the continuous miner with the remote controller placed on top of the machine. Safe work practices were not being followed. The miner operator was operating the miner while walking beside the machine with the remote control placed on top of the machine.
5. *Pilot Butte Mining*, Reliance, Sweetwater Co., WY, 3/29/1990 - The operator was pinched between the right rear corner of the machine and the rib while tramming (trimming bottom) the continuous miner. Safe work practices were not being followed. The roof control plan required operation outside of pinch points so no portion of the body was exposed to sudden movement. Safety features on the remote control were not a factor in this accident because the remote control was pinned against the victim and also because of the speed of the accident. It is also believed that the machine would have slid down the slope enough to pin the operator even if stopped by the remote control.
6. *Pontiki Coal Corp., Pontiki No. 2 Mine*, Pilgrim, Martin Co., KY, 11/12/1990 – An electrician was pinched between the conveyor chain and the conveyor chain guard during maintenance. The accident occurred while the victim was in the conveyor boom of a continuous mining machine troubleshooting the remote control circuit for the water spray system. Other co-workers who were checking the cutting head bits asked the victim to bump the ripper head with the remote control. In an attempt to do this, the victim accidentally started the conveyor chain resulting in fatal injuries. Safe work practices were not being followed since maintenance was being performed on a machine while the machine was energized. Note: This accident was inadvertently omitted in earlier revisions of this report.
7. *Harman Mining Corp, #1-A Mine*, Harman, Buchanan County, VA, 12/17/1990 – The operator was crushed between the trailing cable support bracket located on the right rear of the machine and the right rib. The continuous miner swerved toward the right rib while the victim was tramming (setting over) the machine to reposition it. Safe work practices were not being followed. The operator had positioned himself within the turning radius of the machine. The roof control plan required operation in a safe location away from machine pinch points. Additionally, the operator was operating the remote control unit with its tram control safety interlocks taped and bypassed.
8. *Bandmill Coal Corp*, Hutchinson, Logan Co., WV, 9/25/1991 - The operator was pinned between the boom and rib on the right side of the continuous miner while tramming (place changing). Safe work practices were not being followed. The roof control plan required operation from the machine cab during tramming, which was not being followed. Safety features on the remote control (remote shutdown switch) were not factors in this accident due to the speed of the accident. An eyewitness indicated the boom pinned the victim's head against the rib allowing no time for him to react.

9. *Powell Mountain Coal Company, Upper Mason No. 1 Mine, St. Charles, Lee County, VA, 9/2/1992* – A continuous mining machine helper's head was pinned between the coal rib and the machine canopy while he was backing the machine to free the cutter bits, which were caught in the line curtain. The victim was tramming (place changing) the machine from an onboard position in the operator's deck using the remote control unit. Safe work practices were not being followed. The helper was tramming the machine from the operator's deck while not being fully protected by the machine canopy. Accumulations of loose coal and a large lunch box prevented the helper from positioning his body entirely in the operator's deck.
10. *Quemahoning Collieries, Hooversville, Somerset Co., PA, 7/19/1993* - The operator was pinched between the cutterhead and rib on the right side of the continuous miner while performing maintenance. The remote controller had a missing antenna and the receiver had a damaged wire which resulted in decreased transmission distance. Safe work practices were not being followed. The miner operator was positioned at a pinch point during maintenance of the machine. Also, the machine was not maintained in permissible condition since the remote control system would not work from a safe distance from the machine.
11. *Penn Run Mining, Penn Run, Indiana Co., PA, 11/5/1993* - A maintenance person was caught in the rotating cutterhead of a continuous miner while performing maintenance. Safe work practices were not being followed. The victim was lying on top of the cutter head to grease a foot shaft bearing while another maintenance person was performing maintenance on the remote controller at the same time. The machine was energized during this maintenance. No design aspects of the remote control system were a factor in this accident since the operator intended to start the machine without verifying the maintenance partner's position.
12. *Red Creek Mining, Shelbiana, Pike Co., KY, 12/27/1993* - The operator was crushed between the boom and the rib on the right side of the continuous miner while tramming (place changing). Safe work practices were not being followed. The roof control plan required during place changing that all persons involved in the move shall be positioned in an area outby the tail (boom) of the miner at all times while the miner is being trammed. The miner operator was positioned at a pinch point during tramming of the machine, which was documented as having occurred before, and was a violation of the approved roof control plan.
13. *White Oak Mining, Scofield, Carbon Co., UT, 3/24/1995* - An operator's helper was crushed between the boom and the rib on the right side of the continuous mining machine while it was being trammed (place changing). Safe work practices were not being followed. The miner operator lost sight of the helper and the miner helper was positioned at a pinch point against the rib when the machine was being moved.
14. *Daniels Branch Mining, Hampden, Mingo Co., WV, 4/18/1995* - A maintenance

person was pinched between the boom and the roof as the conveyor chain pushed him toward the roof during maintenance. A short-circuit in the remote controller caused cross activation of switch functions and unexpected movement. Safe work practices were not being followed since maintenance was being performed on a machine while the machine was energized. The victim was laying on the machine conveyor while another worker was operating the remote control to check for hydraulic fluid leaks.

15. *Little Otter Mining, Itmann, Wyoming Co., WV, 10/21/1996* - The operator was pinched between the right rear corner of the continuous mining machine and the rib as a cable fell across the remote controller which had the mechanical tram interlock safety devices taped and bypassed. The operator was not following safe work practices since he was positioned within the turning radius of the machine. He was also attempting to lift the continuous miner trailing cable while operating (setting over) the machine remotely with the tram interlocks taped and bypassed.
16. *Eighty Four Mining Co., Eighty Four, Washington, Co., PA, 3/28/1997* - The operator was pinched between the left rear corner of the continuous mining machine and the rib while viewing a diagnostic panel for maintenance purposes. Although this machine had an operator's compartment, the foot switch necessary to operate the continuous miner was disconnected. Since the manual controls could not be used to free the victim, this may have been a factor in the severity of the injury. It is not known if the nature of the tramming problem on the machine would have prevented manual operation. Safe work practices were not being followed since the workers placed themselves in a pinch point location next to a machine known to have tram problems.
17. *Golden Chance Mining, No. 3 Mine, Gilbert, Mingo Co., WV, 7/26/1999* - The operator's helper was pinched between the conveyor boom and the roof as he was handling the trailing cable while the continuous miner was being trammed (place changing). Safe work practices were not being followed. The operator lost sight of the helper, while the helper was too close to the machine. The approved roof control plan required that while operating the continuous-mining machine, the continuous-mining machine operator shall assure that all persons are in a safe location.
18. *Leeco Coal Company, No. 74 Mine, Slemp, Perry County, KY, 1/21/2000* - The maintenance person operating the continuous miner came in contact with the rotating cutterhead while changing bits. Safe work practices were not being followed since the operator was too close to the cutter head without having the machine de-energized. No "faults" were found on the machine or remote control system that would have contributed to the accident, although a non-permissible jumper was installed that bypassed the safe pump startup sequence.
19. *Buchanan Production Co. Mine No. 2, Grundy, Buchanan Co., VA, 5/12/2000* - The operator was pinched between the right rear corner of the continuous mining machine by the trailing cable support bracket and the rib while tramming (setting

over) the machine. The workers were not following safe work practices since they were within the turning radius of the machine. One was almost struck by the boom, and the other was crushed against the rib. The approved roof control plan for this mine indicated that "At anytime the continuous mining machine is being trammed by remote control, the continuous mining machine operator and all other persons must be outside of the machine's turning radius and away from pinch points created by either the continuous mining machine and/or other equipment."

20. *Manalapan Mine No. 16*, Highsplint, Harlan County, KY, 8/15/2000 - The operator and his helper were both pinched between the right rear corner of the continuous mining machine and the rib while trampling (place changing) to a new section. The helper was moving the trailing cable and did not receive fatal injuries. Safe work practices were not being followed since both the operator and the helper were within the machine's turning radius while the machine was being trammed from one section to another. The approved roof control plan for this mine indicated that "the continuous mining machine operator and all other persons must be outside of the machine's turning radius and away from the pinch points."
21. *Pine Ridge, Whites Branch Mine*, Gordon, Boone Co., WV, 4/12/2001 - A remote controlled continuous mining machine operator was pinned between the conveyor boom and the rib when the cutter head of his machine, which was partially into a crosscut intersection, was struck by another continuous miner cutter head as it was being trammed (place changing) forward. The impact caused the struck machine to pivot and the conveyor boom pinned the victim. The victim was positioning the trailing cable along the right side of the machine in preparation for moving it when the accident occurred. The victim's machine pump was turned on, but the machine was not in motion.
22. *Gibson County Coal, Gibson Mine*, Princeton, Gibson Co., IN, 11/21/2001 - A continuous mining machine operator received fatal crushing injuries when he came in contact with the machine's cutter head and the coal rib. The victim had completed mining in a crosscut and was trampling (place changing) the machine from one entry to another, at the time of the accident. The operator was not following safe work practices since he was located within the machine's turning radius.
23. *Massey Energy, Rockhouse Energy No. 1 Mine*, Sidney, Pike Co., KY, 3/22/2002 - A section foreman operating a continuous mining machine was fatally injured when his head was pinned between the conveyor boom and rib while trampling (place changing) the machine in reverse. He was located on the right side of the machine and had one trailing cable strap hooked on the conveyor boom at the time of the accident with the boom located all the way toward the rib on the right. Safe work practices were not being followed. The miner operator was positioned at a pinch point during trampling of the machine, which was a violation of the approved roof control plan.

24. *Titan Mining, Laurel Fork Deep Mine*, Eskdale, Kanawha County, WV, 8/12/2002 - The head of the operator's helper was caught between the conveyor boom tip and the roof as he was handling the trailing cable while the continuous miner was being trammed (place changing) forward to the surface for repairs. The front of the machine dropped over a 8" to 10" ledge in the mine floor causing the conveyor boom to strike the roof. Safe work practices were not being followed. The operator lost sight of the helper, while the helper was too close to the machine.
25. *Freeman United Coal, Crown III Mine*, Farmersville, Macoupin Co., IL, 4/15/2003 – The operator was pinned between the left rear of a continuous mining machine and the left rib while positioned behind the ventilation line curtain and tramping (setting over) the machine in reverse to clean up the left side of the cut. Safe work practices were not being followed. The miner operator was positioned at a pinch point during tramping of the machine, and was tramping the machine from behind the line curtain without having the machine in full view.
26. *Paramont Coal Company, VICC No. 7 Mine*, Coeburn, Wise Co., VA, 10/22/2003 – A continuous mining machine operator was fatally injured when he was pinned between the right side cutter boom and the rib of the outby coal pillar. The operator was tramping (place changing) the machine forward for an end-cut while second mining a coal pillar when the machine pivoted to the right, pinning him. Safe work practices were not being followed. The miner operator was positioned at a pinch point during tramping of the machine.
27. *OCI Wyoming LP, Big Island Mine & Refinery*, Green River, Sweetwater Co., WY, 2/1/2004 – A roof bolter operator was fatally injured at an underground trona mine. The victim left the roof bolting station mounted on the remote controlled continuous miner without activating the emergency stop switch located in his operator's cab. The miner operator, standing on the other side of the continuous miner, backed it (place changing) from the face after loading the last shuttle car. The victim tried to pass between the conveyor boom and rib when he was struck and pinned against the rib.
28. *Brooks Run Mining Company LLC, Mercer Deep Mine*, Erbacon, Webster Co., WV, 4/3/2004 – A continuous mining machine operator was fatally injured when he was crushed between the right side of the cutter head and the rib while tramping (place changing) the machine forward to position it for a straight-on cut. The victim was positioning the machine while standing near the front and looking back toward the boom. Safe work practices were not being followed. The miner operator was positioned at a pinch point during tramping of the machine.
29. *Black Beauty Coal Company, Air Quality #1 Mine*, Vincennes, Knox County, IN, 5/18/2004 – A mechanic was fatally injured while positioning a continuous mining machine for servicing. The victim was pinned between the right side of the conveyor boom and the coal rib when the machine slewed toward the rib while backing. Safe work practices were not being followed. The mechanic was positioned at a pinch point during tramping of the machine.

30. *Rosebud Mining Company, Little Toby Mine, Brockport, Elk County, PA, 4/18/2008* - A continuous mining machine operator was fatally injured when he was crushed between the attached mobile bridge conveyor (MBC) basket and the rib while mining into a 60 degree crosscut. The victim was outside the turning radius of the continuous miner's boom, but not the attached basket. The accident was not believed to have been as a result of tramming the MBC or continuous miner, but rather by rotating the continuous miner's boom. Safe work practices were not being followed. The miner operator was positioned at a pinch point while attempting to move the boom and basket towards him.
31. *White County Coal LLC, Pattiki Mine, Carmi, White County, IL, 10/16/2008* – A continuous mining machine operator was fatally injured when he was crushed between the cable horn (trailing cable strain relief) and the rib. The operator was substituting for the normal operator who was on a lunch break. The victim had just finished loading shuttle cars when a belt had unexpectedly stopped. When the shuttle cars did not return to the section, the victim backed the continuous miner from the face with unknown intentions when he was pinned against the rib.
32. *ICG Beckley LLC, Beckley Pocahontas Mine, Eccles, Raleigh County, WV, 4/22/2010* – A continuous mining machine operator was fatally injured when he was crushed between the conveyor boom and the rib. The victim was crushed while moving the off standard continuous miner to a new location (place changing). The boom of the miner was swung to the operator's side in an attempt to keep the slack cable against the rib.
33. *James River Coal Company, Leeco Incorporated #68 Mine, Jeff, Perry County, KY, 6/24/2010* – A continuous mining machine operator was fatally injured when he was crushed between the cable horn (trailing cable strain relief) and the rib. The operator was tramming (trimming bottom) the machine along the right rib line to clean up loose coal on the mine floor. When the operator turned the front of the machine to the left, he became pinned between the machine and the rib.
34. *Matrix Energy LLC, No. 1 Mine, Lovely, Martin County, KY, 3/25/2011* – A continuous mining machine operator was fatally injured when he was crushed between the conveyor boom and the rib. The operator was tramming (place changing) the machine in preparation to cut a cross-cut. The machine was trammed forward to pull up cable slack with the conveyor boom swung fully to the right. The operator then trammed the machine in reverse to remove the rope used to pull the cable when he was pinned.
35. *Coal River Mining LLC, Fork Creek No. 10 Mine, Sumerco, Boone County, KY, 7/27/2012* – An operator's helper was crushed between the conveyor boom and the rib on the right side of the continuous mining machine while it was being trammed (place changing). The miner helper was positioned at a pinch point against the rib when the machine was being moved. The operator and helper secured the trailing cable to the boom with nylon rope. The operator then instructed the helper to get in the clear while the machine was moved. The

operator was positioned at the cutter head end of the machine while the helper was outby the tail end while the machine was trammed in reverse. The operator inadvertently shut down the machine while bending over to pull cable out from near the gathering head pan area. The operator then restarted the machine and continued tramping in reverse until he heard a yell. The helper was observed pinned to the rib and had nylon rope in his hand.

36. *Big Ridge Inc, Willow Lake Portal, Equality, Saline County, IL, 11/17/2012* - A continuous mining machine operator was fatally injured when he was crushed between the left side of the cutter head and the rib while tramping (setting over) the machine to mine the right side of the crosscut. The victim was positioning the machine while standing near the front of the machine. There were no eyewitnesses to the accident. The miner operator was positioned at a pinch point during tramping of the machine.
37. *Knight Hawk Coal LLC, Prairie Eagle South Underground Mine, Cutler, Perry County, IL, 2/13/2013* - A continuous mining machine operator was fatally injured when he was crushed between the right side of the conveyor boom and the rib while tramping (setting over) the machine to mine the final cut on the left side of the entry. The victim was positioning the machine while standing at the rear of the machine. There were no eyewitnesses to the accident. It is believed that a combination of tramping and boom movement caused the accident. A contributing factor to the accident was damage to the valve bank and conveyor swing solenoid that would prevent stopping of the conveyor boom when the remote control switch was released.
38. *Dominion Coal Corporation, Mine No. 30, Jewell Ridge, Buchanan County, VA, 2/21/2014* - A continuous mining machine operator was fatally injured when he was crushed between the right side of the conveyor boom and the rib while tramping (place changing) the machine to continue mine advancement in the #1 entry. There were no eyewitnesses to the accident. The trailing cable and a waterline were being pulled by the continuous miner on its right side to the #1 entry. The middle of the boom, on the right side, contained a hook used to pull sections of the cable and waterline. It is believed that tramping of the machine and not boom movement caused the accident. The boom was positioned to the far right to aid in positioning of the trailing cable.
39. *LCT Energy, LP, Brubaker Mine, Hooversville, Somerset County, PA, 1/28/2015* - A continuous mining machine operator was fatally injured when he was crushed between the right side of the conveyor boom and the rib while tramping (place changing) the machine to begin mining in the #5 entry. There were no eyewitnesses to the accident. It is believed that tramping of the machine and not boom movement caused the accident.

## **Conclusions**

A study of the accident summaries resulted in the following summary conclusions as to how and where the accidents occurred:

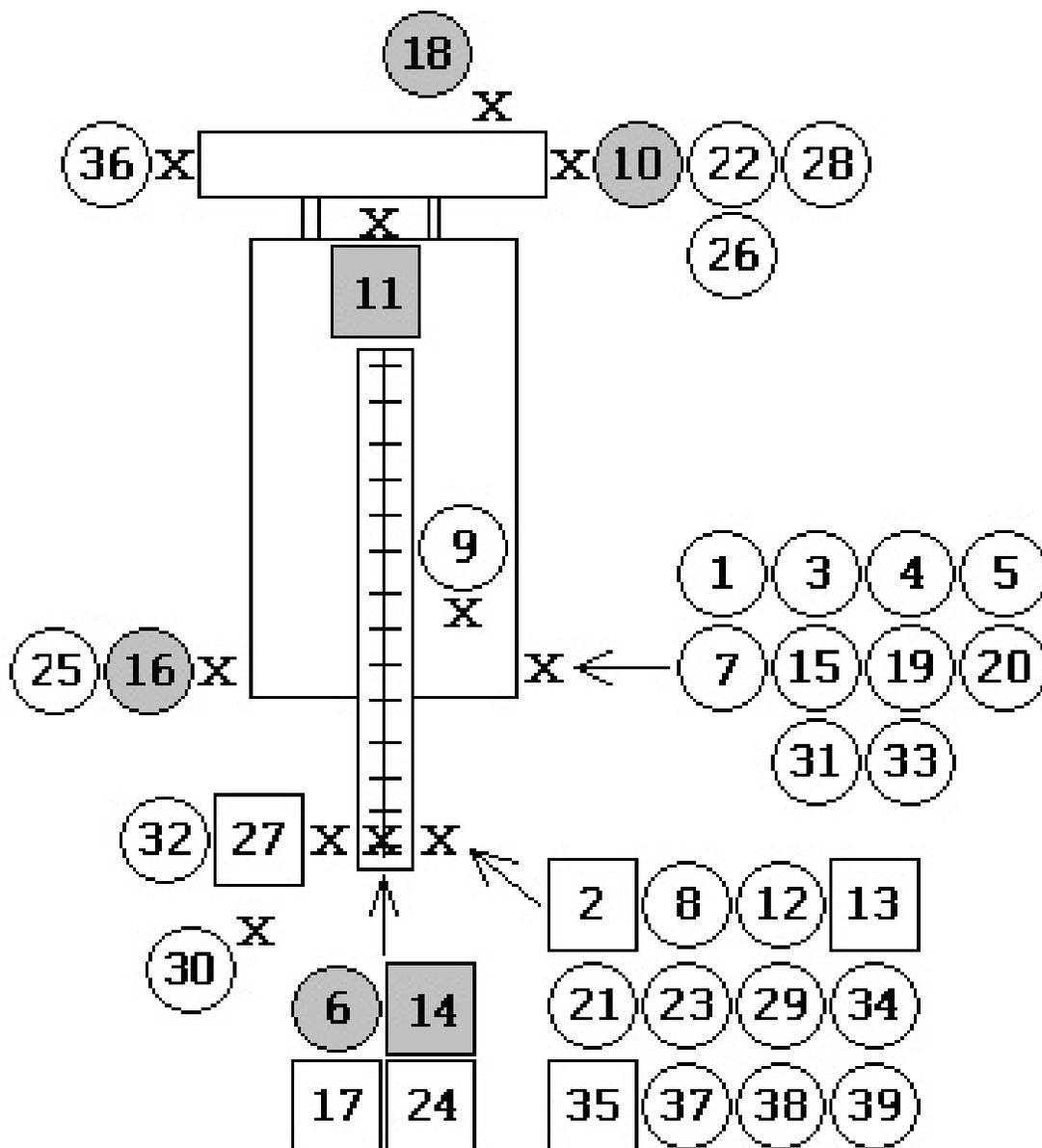
1. All of the fatal accidents involved a remote controlled continuous mining machine.
2. Trimming the machine was the most dangerous work function (32 out of 39 fatalities). Of the seven exceptions, six involved maintenance, and one, accident number 30, was believed to be caused by boom movement rather than trimming.
3. Performing maintenance was the second most dangerous work function (6 out of 39 fatalities).
4. Of the 32 trimming accidents, 23 occurred while placing changing (this includes movement of the machine for unknown reasons and preparation for maintenance). 7 occurred while setting over, and 2 occurred while trimming bottom.
5. The machine operator was most at risk (30 out of 39 fatalities). The one exception to the number of circles in Figure 1 is accident number 21 since the operator was not trimming the machine at the time of the accident.
6. Most pinning and crushing accidents occurred on the right rear side of the machine (23 out of 39) with eleven fatalities occurring at the right rear machine corner and twelve occurring at the conveyor boom. The four operator fatalities occurring at the left side of the machine during non-maintenance work were with machines designed for left side operation.
7. Of the seven fatalities involving the cutter head, three occurred while performing maintenance and four while trimming.

The accident analysis shows that poor work practices were contributing factors in all of the accidents. This confirms the importance of establishing good work practices, providing periodic training to emphasize the importance of following good work practices, and the need for follow-up checks to ensure they are being followed by mine personnel.

The high incidence of poor work practices in the fatal accidents also highlights the dangers associated with the psychological detachment from the machine and complacency that develops in the minds of the operators with the use of remote control technology. Because of these factors, established work practices and training alone are not sufficient to prevent the type of accidents that have occurred.

Technology has advanced and allowed new design safety features and design approaches that may protect the operating personnel even when safe work practices are not followed. One of these safety features, that may help prevent the type of accidents that have occurred, is proximity detection. This feature provides automatic proximity detection and machine shutdown to protect personnel from being crushed, struck, or pinned when they are inadvertently positioned in a hazardous area in close proximity to the machine. It is estimated that the use of proximity detection with machine shutdown could have been a preventative factor in 32 of the 39 fatal accidents (except 6, 9, 11, 14, 21, 27, and 30) analyzed above. The technology for proximity detection currently exists and its use on mobile mining machinery is recommended.

### Location of Remote Control Victims With Respect to Machine



**Figure 1**

Note: Numbers refer to the number of the accident in the Accident Summary of this analysis. The "X" indicates general location of fatality. Gray background indicates accidents that occurred while performing maintenance. The square around numbers indicates the victim was not operating the machine, and circled numbers indicate the victim was operating the machine (person in possession of remote control at time of the accident).