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Mine Safety and Health Administration
1100 Wilson Boulevard
Room 2350
Arlington, VA 22209-3939

Comments on RIN 1219-AB65, Proximity Detection Systems for Underground Mines

To whom it may concern,

Matrix Design Group, LLC (Matrix) and Alliance Coal, LLC (Alliance) are submitting the following comments in response to the Request for Information as documented in the Federal Register, volume 75, No. 20 dated February 1, 2010.

Matrix and Alliance have been jointly working on proximity detection technology since 2005. Both Matrix and Alliance have a significant amount of resources invested in the project and can provide valuable input on this subject. Matrix and Alliance have actively participated in meetings and discussion with the Mine Safety and Health Administration (MSHA), West Virginia Mine Safety Technology Task Force,and the National Institute for Occupational Safety and Health (NIOSH) regarding evaluation standards and system functionality standards. Additionally, Matrix recently entered into a partnership with Joy Mining Machinery to commercialize a highly reliable proximity detection system for remote control continuous mining machines (RCCMs).

Currently, Matrix has three fully operational proximity detection systems undergoing long term field evaluation at different mines operated by Alliance. Additionally, two complete systems are installed and ready for testing at another Alliance mine and Matrix has been working with NIOSH to conduct operator behavioral studies on perceptions of continuous miner safety practices and the effects of proximity detection systems on operator behavior. Matrix and Joy plan to release new hardware for continued trials in the May-October 2010 timeframe with a preliminary release scheduled for late 2010.

Matrix and Alliance believe that the key to a successful RCCM proximity detection system is operator acceptance and the key to operator acceptance is system reliability. If the system is not reliable, RCCM operators will not trust the technology and therefore find ways to not use the system. Matrix is committed to developing a reliable system and will not release a system to market until sufficient long term testing has been completed. Matrix believes most mine operators will voluntarily install proximity detection systems on RCCMs when reliable systems are made available. Alliance has voluntarily committed to install the Matrix proximity detection system on its entire fleet of RCCMs. Additionally, other operators have expressed interest in the Matrix system.

Please find the following responses to each of the 25 questions listed in the Information Request:

1. Please provide information on the most effective protection to miners that you believe proximity detection systems could provide, e.g., warning, stopping the equipment, or other protection. Include your rationale.

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Disabling RCCM tram and conveyor swing functions will provide the most effective protection. Minimizing the impact on the RCCM operation when the red zone is breached to only those functions that can cause the machine to move toward the operator will increase operator acceptance. Operator acceptance is the key to a successful system.

2. Other than electromagnetic field based systems, please address other methods for effectively achieving MSHA's goal for reducing pinning, crushing, and striking hazards in underground mines.

Any technologies or methods that can be used to enhance underground miner safety training and awareness programs can be effective in achieving the fundamental goal shared by MSHA and the industry for increasing worker health and safety. Electromagnetic field based systems have demonstrated that they are capable of helping achieve this important goal.

Comprehensive and complete training of miners is critical and should include two stages: 1) knowledge learning; and 2) practical application of that knowledge. Conventional training would address the knowledge component through instructor-led PowerPoint presentations, videos or other computer-based training. The practical application of that knowledge is commonly handled through live, real-world training simulations or on-the-job training in the miner's actual working environment (Task Training).

'Virtual Reality' type training is an excellent tool to supplement the 'conventional' training methods. Using virtual environments mimics on-the-job training. Trainees are given knowledge, then immediately asked to apply that knowledge to a task or situation in the virtual environment. The application of the knowledge often requires completion of hazard recognition and decision-making skills. The virtual training environment provides learners with a context for what they are learning which contributes to a higher retention. This training method also allows the trainee to learn the skill in a controlled safe learning environment in which hazards are only perceptional.

RCCM simulators can help to prepare miners for real life in-mine situations. The simulators are fully functional and allow miners to manipulate the knobs and levers without being exposed to any hazards. The training is also much more accessible to miners because they are not required to travel into the mine to train on active mining equipment.

Once the training is complete, Safety Systems should incorporate a Behavior Observation program to evaluate the effectiveness of the training. Detecting/correcting unsafe working practices promptly and recognizing safe work practices are two of the basic principles of accident prevention. The purpose of job Behavior Observations is to observe employees doing their respective jobs to learn whether or not they are working safely. By performing observations on a regular and systematic basis, the job Behavior Observation process helps insure that employees follow Safe Job Standards. Quality Behavior

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Observations should identify and eliminate 'at risk' behaviors, as well as identify and encourage 'safe' behaviors. The Observation should provide immediate feedback to the employee. A critical part of the Observation is the discussion and follow-up with the employee.

3. In general, reliability is defined as the ability of a system to perform when needed. Please provide information on how to determine the reliability of a proximity detection system. The Agency would appreciate information that describes reliability testing, how reliability is measured, and supporting data.

   Proximity detection systems should be as reliable as the mobile machinery on which they are installed. A reliable system for RCCMs requires mine-hardened components as well as reliable technology. The design and installation of a proximity detection system must be properly coordinated with the design of mining machinery in order to achieve acceptable reliability goals.

4. Manufacturers should design their systems to be fail-safe. Please provide information on how miners would know when a proximity detection system is not working properly. Include suggestions for what works best, including your experience, if applicable.

   Fail-safe means that ANY failure of the system would result in disabling the RCCM. Given all of the elements present in the mining environment, it may not be possible to develop a fail-safe proximity detection system. Indicator lights should be provided to display system status to the operator.

5. Please describe procedures that might be appropriate for testing and evaluating whether a proximity detection system is functioning properly. Include details such as the frequency of tests and the qualifications of persons performing tests; include specific rationale for your suggestions.

   The RCCM operator should perform validation testing at the beginning of each shift to ensure the system is operating properly. This validation can be as simple as entering the red zone and ensuring the proximity detection system is functioning.

6. Some proximity detection systems provide a warning before the equipment shuts down. An excessive number of warnings can cause miners to become complacent and routinely ignore them as nuisance alarms. Please describe any experience you have had with nuisance alarms and how you addressed these alarms to assure an appropriate level of safety for miners. In addition, please provide suggestions for minimizing nuisance alarms.

   An operator cannot routinely ignore an alarm if it results in equipment shut down. A visual warning light alerting the operator that they are approaching the shut down zone will help teach the operator to avoid positioning themselves in hazardous locations.

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7. How should the size and shape of the area around equipment that a proximity detection system monitors be determined? What specific criteria should be used to identify this area, e.g., width of entry, seam height, section type, size of equipment, procedures for moving equipment, speed of equipment, and related information? Please provide any additional criteria that you believe would be useful in identifying the area to be protected.

   The size and shape of the area monitored should be determined by the physical characteristics of the equipment along with the specific machine function. An RCCM that is tramming presents different hazards than an RCCM that is cutting coal. The areas monitored should be adjusted appropriately based on machine function to ensure that operators are not exposed to other hazards by positioning themselves as required by a proximity detection system.

8. Proximity detection systems can be programmed and installed to provide different zones of protection depending on equipment function. For example, a proximity detection system could monitor a larger area around the RCCM when it is being moved and a smaller area when the machine operator is performing a specific task, such as cutting and loading material. How should a proximity detection system be programmed and installed for each equipment function?

   The size and shape of the detection zone should be changed based on the function of the machine. If the machine is tramming at slower speeds, smaller red zones can be utilized, making the machine more usable to the operator. One example, during loading, the operator needs to stand near the tail of the machine, near the shuttle car. If the red zone is too large during this function, the operator could be forced out into another dangerous area.

9. Since 1983, six fatalities occurred while miners performed maintenance on RCCMs. The fatalities involved three miners crushed in the machine and three miners pinned between the machine and mine wall or roof. Please provide specific information, including experience, on how a proximity detection system might be used to protect miners during maintenance activities and why the system would be effective in each situation.

   Ensuring the safety of miners performing maintenance functions on RCCMs can not be accomplished with technology only. A combination of technology and proper training are required for the safety of all miners.

10. Some proximity detection systems include an override function that allows the system to be temporarily deactivated. Please provide information on whether an override function is appropriate and, if so, please provide information on the circumstances under which such a function should be used. Please provide information on the types of procedures or safety precautions that could be used to prevent unauthorized deactivation of a proximity detection system.

    Temporary deactivation of the proximity detection system will be required during events such as a system failure while under unsupported roof. Proximity

detection systems can be integrated with machine emergency stop override controls to temporarily deactivate the system.

11. MSHA found, in its field testing experience that the use of some new technology for controlling motor speed, like variable frequency drives, could result in nuisance or false alarms (shutdowns) from the proximity detection system. Please provide information on other sources of interference, if any that might affect the successful performance of proximity detection systems in underground mines. In addition, please provide information on whether a proximity detection system might adversely affect other electronic devices, such as atmospheric monitoring systems, used in underground mines. Please provide specific circumstances including: (1) types of equipment; (2) adverse effect; and (3) how the adverse effect could be minimized.

    Interference can occur from electrical sources such as electronic motor controls or from ferromagnetic materials that are present on the machine or in the mining area. We have not observed any interference issues between our proximity detection system and mine equipment such as communications, tracking or atmospheric monitoring systems.

12. Commenters who have experience with RCCMs, please describe: (1) any experience with pinning, crushing, and striking hazards, including accidents and near misses; and (2) any unique experience with an RCCM with auxiliary equipment attached.

    We have no experience with accidents or RCCMs with auxiliary equipment attached.

13. How should the area that a proximity detection system monitors be determined on an RCCM interconnected with auxiliary equipment?

    We have no experience with accidents or RCCMs with auxiliary equipment attached.

14. Describe whether there are safety benefits from applying proximity detection systems to underground equipment other than RCCMs. Describe your experience with pinning, crushing, or striking accidents and near-misses involving other underground equipment. Please provide examples identifying the specific types of equipment involved and how proximity detection systems may help provide an additional margin of safety to miners. Also describe any experience you have with respect to obtaining MSHA or other agency approval for systems designed for underground equipment other than RCCMS.

    Applying proximity detection systems to all mobile equipment should be a long term goal that could provide safety benefits. However, it is important to recognize that the development of proximity detection systems for RCCMs is still in the early stages. It is premature for MSHA to consider any type of rulemaking for the application of proximity detection systems on other types of mobile underground equipment.

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15. How might a proximity detection system for remote controlled equipment be different than one for non-remote controlled equipment?

The operator may not need to be protected as long as they are riding on the machine. However, other personnel who could be exposed to pinning, crushing or striking accidents would still need to be considered.

16. Manufacturers are evaluating the use of proximity detection systems on multiple pieces of equipment that operate near each other, such as RCCMs and shuttle cars. In your experience, what are the safety considerations of coordinating proximity detection systems between various types of underground equipment?

Multiple pieces of equipment operating in close proximity should be attainable as long as the same technology is used on the equipment. Testing on this theory will be required to ensure proper function.

17. Describe your experience with the state-of-the-art of proximity warning technology. Include any experience related to whether the current technology is able to accurately locate and protect workers from all recognized hazards.

The combination of technology and training are required for successful safety of personnel. Proximity detection systems should be used as a tool to TRAIN and TEACH operators to stay out of danger zones and not a system that will always protect the operator from all hazards.

18. What knowledge or skills would be necessary for miners to safely operate equipment that uses a proximity detection system? What knowledge or skills would other miners working near the equipment need?

Maintenance personnel and operators will require training to ensure they understand proximity detection system functionality and any maintenance requirements. Most importantly, personnel need to be taught that the proximity detection system is designed as a training aid to help them be more aware of the danger zone, and taught that the combination of a proximity detection system and their awareness are required for their safety. Ultimately, the combination of technology and training are required for success.

19. Please provide suggestions on how to effectively train miners on the use and dangers of equipment that uses a proximity detection system. Please include information on the type of training (e.g., task training) that could be used and on any evaluations conducted on the effectiveness of outreach and/or training in the area of proximity detection (e.g., red zone warning materials). How often should miners receive such training?

Again, maintenance personnel and operators will require training to ensure they understand PDS functionality and any maintenance requirements. Most importantly, personnel need to be taught that the proximity detection system is

designed as a training aid to help them be more aware of the danger zone and taught that the combination of a proximity detection system and their awareness are required for their safety. Ultimately, the combination of technology and training are required for success.

20. Please provide information on the benefits of using proximity detection systems with RCCMs. Please be specific in your response and, if appropriate, include the benefits of using proximity detection systems with other types of underground equipment. Include information on your experience related to whether proximity detection systems cause a change in the behavior of an RCCM operator. For example, would the operator need to operate the machine from a different location, such as one that might introduce additional hazards, to remain outside of a predefined danger zone? Please explain your answer in detail and provide examples as appropriate.

    From our trials to date we have had good, positive feedback from operators on the functionality of our system. Our system has the intelligence to determine operator location around the machine and change the shape of the red zone based on machine function. One example, during loading, the operator needs to stand near the tail of the machine, near the shuttle car. If the red zone is too large during this function, the operator could be forced out into another hazardous area.

21. Please provide information on the costs for installing, maintaining, and calibrating proximity detection systems on underground equipment. What are the feasibility issues, if any, related to retrofitting certain types of equipment with proximity detection systems?

    The proper installation of a proximity detection system is critical for reliable performance. If designed and installed properly, a proximity detection system can be reliable and easy to maintain.

22. What is the expected useful life of a proximity detection system? Please provide suggested criteria for servicing or replacing proximity detection systems, including rationale for your suggestions.

    The survivability of the components will be determined by the robustness of the installation and guarding provided to the system. If proper engineering and attention are given to the design and installation, a proximity detection system should be usable for the entire time between rebuilds. Spare components should be available and designed for ease of replacement in case of damage or failure.

23. Some proximity detection systems automatically record (data logging) information about the system and the equipment. Are there safety benefits to having a proximity detection system automatically record certain information? If so, please provide specific details on: (1) safety benefits to be derived; (2) information that should be recorded; and (3) how information should be kept.

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Machine function, operator location, and time/date stamp should be recorded and stored for continued development. Additionally, the information could be used to identify areas of improvements in RCCM operator training.

24. Please provide information on whether small mines or mines with special mining conditions, such as low seam or mine entry height, have particular needs related to the use of proximity detection systems. Please be specific and include information on possible alternatives.

We have no experience with the application of proximity detection systems in thin seams with special mining conditions.

25. What factors (e.g., cost, nuisance alarms) have impeded the mining industry from voluntarily installing proximity detection systems on mining equipment?

Alliance has voluntarily committed valuable resources to ensure the successful development of a reliable proximity detection system. Alliance has committed to install the Matrix proximity detection system on its entire fleet of RCCMs. Additionally, other operators have expressed interest in the Matrix system. The Matrix system will be available by the end of 2010. Matrix is confident that most operators will voluntarily install proximity detection systems as soon as a reliable system is available.

Thank you for the opportunity to comment on this Request for Information on Proximity Detection Systems. If further information or clarifications are required, please contact Aric Pryor by email at: aric.pryor@matrixdginc.com or by telephone at: (812) 858-8024.

Thank you,

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