

Infrastructure for Integrated Data Environments and Analysis (IIDEA) for Mining and Processing Systems

The project team will lower energy costs in all phases of mining and processing through better monitoring and understanding the production processes. It will develop an Infrastructure for Integrated Data Environments and Analysis (IIDEA) that will facilitate the development of Process Knowledge (PK) and Holistic Process Control Models (HPCM). The proposed work will develop the core components of the IIDEA: an integrated data infrastructure and analysis and testing environments. These are a set of methodologies, information models, software architectures, and analysis and simulation tools. This new mine engineering/management toolbox is specifically for 1) analyzing mining data and processes, 2) generating process knowledge, and 3) designing and validating actions that would improve the mining system.

The project addresses the common issue of being ‘data rich but information poor.’ Modern mines are employing technology and equipment that is generating increasingly more data such as geological databases, truck/shovel or conveyor monitoring systems, and enterprise systems. Therefore new tools are needed to analyze these huge (gigabytes in size) datasets to generate information. As additional efforts are placed on developing information an additional problem arises: how to go from information, to knowledge building, to action that can save the operation money and energy. The IIDEA will facilitate the evolution of data to actions using methodologies proven successful in other business sectors. The approach involves extracting, cleaning, and integrating data from multiple sources such as mine planning software, process monitoring systems (i.e. truck dispatch), and enterprise systems. Using mining domain knowledge and information engineering techniques called data mining, knowledge (such as process interactions) can be discovered from the integrated data. To evolve the knowledge into actionable strategies, automated controls or decision support tools need to be developed. These HPCM would need to be tested prior to deployment since the models are complex. Therefore a testing environment would be required within the IIDEA.

To prove that the IIDEA can enable and facilitate the creation of highly effective process control, two HPCM will be developed and deployed at operating mines; 1) a mine-to-leach (M2L) system that can identify the needed changes in production processes to improve heap leach performance, and 2) an activity-based energy consumption model (ECM) that can measure energy consumption in real-time based on process activity. These HPCM expect to achieve a measurable energy and cost savings of 16% and additional 10% improvement in heap leach recovery.

The key benefits to developing the IIDEA are step-changes in the measurement, understanding, and control of mining and processing systems. The IIDEA will facilitate the affordable and sustainable implementation of other HPCM such as mine-to-mill optimizations or activity-based budgeting. Traditionally, these models are not feasible in most operations because they require substantial labor in collecting, organizing, filtering, editing, and analyzing the data. These information engineering skills are not common in mining companies. Therefore, control models should be developed using generic tools specifically designed to integrate and analyze mining data. Such control models will help mines develop effective mechanisms to ‘work smarter, not harder’. The technology would give domestic or 1st world companies a competitive edge since only mines with modern data-generating equipment and information systems would be improved through data-driven technology.

The project will be led by Dr. Sean Dessureault of the University of Arizona’s Mining and Geological Engineering department. Technical contributors include Dr. Rajive Ganguli of the University of Alaska Fairbanks, Dr. Vladislav Kecojevic of Pennsylvania State University, and Dr. Antonio Nieto, Virginia Polytechnic Institute and State University. The industrial partners include: Phelps Dodge Corporation, Mintec Incorporated, and Dimension Technology Solutions. The substantial in-kind support from mining company demonstrates the industrial need for this type of data-driven technology and the strong technology company support demonstrates the technical validity and importance of doing this work.