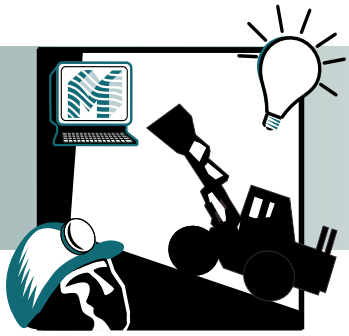
MINING

Project Fact Sheet



Dense-Medium Cyclone Optimization

Benefits

- Increases production rates and efficiencies by reducing the amount of material for disposal
- Reduces energy requirements in separation of waste material
- Reduces processing costs

Application

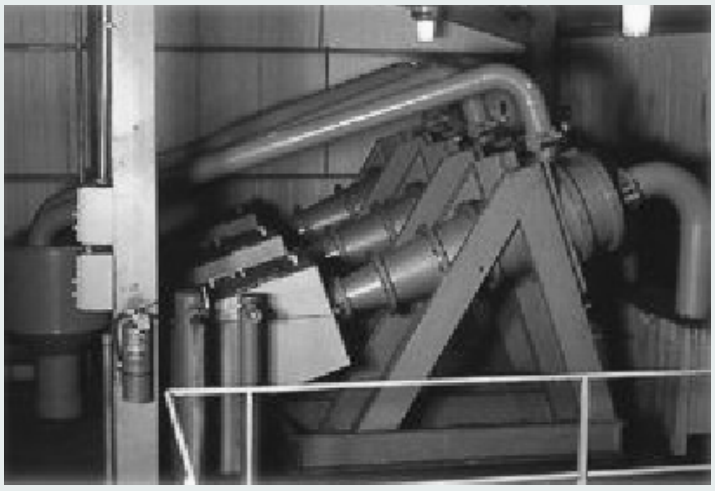
Dense-medium cyclones are used as separators in most modern coal plants and in a variety of mineral plants treating iron ore, magnesite, dolomite, diamonds, potash and lead-zinc ores.

Dense-medium cyclone optimization increases the amount of valuable materials recovered

This project will develop a set of engineering tools to allow plant operators to improve the efficiency of their dense-medium cyclone circuits. Dense-medium cyclones are versatile separators known to be efficient, high-tonnage devices suitable for upgrading particles in the 50 to 0.5 mm size range. Unfortunately, the knowledge base required to properly design and operate dense-medium cyclones is often not available to those in the industrial sector. In particular, operators are often unaware of the adverse impacts that normal variations in operating conditions (such as medium quality or apex wear) have on dense medium cyclone performance. There is also little guidance available regarding the operation of dense medium cyclone circuits for treating coarser particles and minerals other than coal.

Three engineering tools will be developed to improve dense medium cyclone operations. These are (1) low-cost density tracers that can be used by plant operators to rapidly assess dense-medium cyclone performance, (2) mathematical process models that can be used to predict the influence of changes in operating and design variables on dense-medium cyclone performance, and (3) a model-based expert system that provides plant operators with a user-friendly interface for evaluating, optimizing, and trouble-shooting dense-medium cyclone circuits. The field data required to develop these tools will be collected by conducting detailed sampling and evaluation programs at four industrial plant sites. These data will also be used to demonstrate the technical, economic, and environmental benefits that can be realized through the application of these engineering tools.

Dense Medium Cyclone



Bank of three DMCs in operation at a coal preparation plant.

Project Description

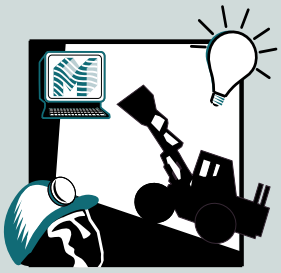
Objective: To develop a set of engineering tools that will improve the efficiency of dense-medium cyclones used to separate coal or minerals from waste rock. These improvements will reduce the energy costs associated with the process and increase the amount of valuable materials that are recovered as product.

The focus of this project will be to conduct a baseline evaluation of four industrial plant sites in Kentucky, Virginia, and West Virginia to assess the performance of existing dense medium cyclone circuits. The study will make use of engineering tools such as density tracers and advanced process models to formulate recommendations for improving dense-medium cyclone performance. The plant circuits and/or operating practices will then be modified based on the data and analyses resulting from the baseline evaluation. A post evaluation will then be conducted at each of the four industrial sites to quantify the extent of improvement achieved. Finally, the extensive database collected during both the baseline and post evaluations will be used to develop an expert system that can be used for future evaluation, simulation and optimization of dense-medium cyclone circuits at other industrial sites.

Progress and Milestones

This project includes the following activities:

- A baseline assessment and evaluation, including density tracer tests, will be performed to establish the existing performance of the dense-medium cyclone circuits at each of the four selected plant sites.
- An evaluation of all primary ancillary operations will be performed at each of the four plant sites to resolve any problems that may be identified during the baseline evaluation of the dense-medium cyclone circuits.
- A baseline report will be prepared and submitted to personnel at each plant site upon completion of the baseline evaluation.
- Personnel at each plant site will draft a plant modification plan after completing the baseline evaluation.
- A second assessment of dense-medium cyclone circuit performance will be conducted at the four sites to evaluate performance improvements.
- A follow-up report will be drafted including information collected during the second assessment. The report will include a detailed calculation of the financial gains resulting from the recommended modifications.
- Samples collected during the course of this work will be analyzed for dry mass and solids content. Representative splits of these samples will be subjected to detailed float-sink tests and the resultant fractions analyzed for ash and sulfur content.
- Flow rates and assay values measured around the dense-medium cyclone circuit will be entered into a multi-component material balancing program and adjusted to obtain a consistent and reliable set of data.
- An expert system for dense-medium cyclone circuits will be developed that can be used by engineering firms and plant operators to design circuits, diagnose operating problems, and optimize performance.



Project Partners

Virginia Polytechnic Institute
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Massey Coal Services
Chapmanville, WV

Precision Testing Laboratory
Beckley, WV

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January 2001