

## **EVALUATING INDUSTRIAL MINERAL BY-PRODUCTS FOR REUSE & MARKET POTENTIAL**

Dario Hadziselimovic

Industrial manufacturing operations frequently generate mineral by-products that are traditionally managed as waste. However, with proper technical evaluation and market analysis, many of these materials can be transformed into valuable commercial resources.

This white paper highlights how PEC Consulting Group LLC (PEC Consulting) assisted a manufacturing client in evaluating mineral by-product streams for beneficial reuse. The assessment, driven by the client's sustainability goals and desire to reduce landfill disposal, identified several opportunities for resource recovery and the development of value-added markets for these materials.

The results of this evaluation illustrate a broader opportunity for manufacturers across many industries. As sustainability objectives, disposal costs, and resource efficiency considerations become increasingly important, companies are reexamining by-product streams as potential sources of value. Success depends on thorough material characterization, technical feasibility assessment, and a clear understanding of market requirements.

### **1. PROJECT OVERVIEW**

PEC Consulting was engaged by the client to evaluate mineral by-product streams and assess opportunities for beneficial reuse and commercialization. The objective was to determine whether these materials could be beneficially reused rather than be disposed of in landfills. To accomplish this, PEC Consulting performed an evaluation consisting of representative sampling, laboratory testing, engineering analysis, and market assessment.

#### **1.1. Project Objectives**

The evaluation process focused on the following key objectives:

- Characterize the mineral by-product streams.
- Determine the physical and chemical properties of each material stream.
- Evaluate potential industrial applications.
- Assess compliance with industry standards.
- Identify potential buyers and commercial markets.

### **2. COLLECTION OF REPRESENTATIVE SAMPLES**

The success of any material evaluation begins with representative sampling. PEC Consulting developed a sampling program designed to ensure that each material stream reflected typical site operations.

Documentation and tracking procedures were used to preserve sample integrity prior to laboratory testing. In collaboration with client representatives, samples were collected from strategic locations during site visits to ensure a representative characterization of each material stream. The material streams evaluated and the associated sampling activities are described below.

### **2.1. Material Streams Evaluated**

- Unprocessed Mineral Stream.
- Processed Mineral Stream.
- Waste Stream.

### **2.2. Sampling Activities**

- Identification of representative collection points.
- Collection and documentation of samples.
- Verification of sample representativeness.
- Preparation and shipment for laboratory analysis.

## **3. LABORATORY TESTING & MATERIAL CHARACTERIZATION**

Following sample collection, PEC Consulting coordinated a laboratory testing program to evaluate the physical, chemical, and performance characteristics of each material stream. The testing program was designed to determine the technical suitability of the materials for potential commercial applications.

Laboratory analyses performed included:

- Particle Size Analysis.
- Mineralogical Composition.
- Chemical Composition.
- Functional performance testing.

### **3.1. Key Findings**

- The unprocessed and processed mineral streams exhibited similar physical and chemical characteristics.
- Both mineral streams demonstrated favorable performance properties.
- Material performance testing confirmed the technical viability of the materials for use in cementitious applications.

- The waste stream exhibited distinct characteristics that may be better suited for alternative industrial uses.

#### **4. TECHNICAL EVALUATION & MARKET ASSESSMENT**

With laboratory results complete, PEC Consulting evaluated both the engineering performance and commercial potential of the mineral by-products. The study considered applicable industry standards, market conditions, transportation logistics, and processing requirements.

The testing program confirmed that the two primary mineral streams satisfy recognized performance requirements for use as Supplementary Cementitious Materials (SCMs), presenting opportunities for utilization within the cement and concrete industries. Additional applications were also identified based on materials' chemical and physical characteristics.

Based on the laboratory test results, the following markets were identified as the most promising markets for commercialization:

- Cement manufacturers.
- Supplementary Cementitious Material (SCM) suppliers.
- Ready-mix concrete producers.
- Agricultural applications.
- Industrial and consumer product manufacturers.

##### **4.1. Commercial Considerations**

Commercial success depends on more than laboratory test results. PEC Consulting evaluated several additional factors influencing market viability, including:

- Production volumes.
- Transportation and logistics costs.
- Additional processing requirements.
- Material handling and storage infrastructure.
- Regional market demand.

#### **5. CONCLUSIONS & RECOMMENDATIONS**

This project illustrates how engineering evaluation can help manufacturers transform mineral by-products from disposal liabilities into valuable resources. By combining laboratory testing with market

analysis, PEC Consulting identified commercially viable opportunities while supporting the client's commitment to responsible resource management and environmental sustainability.

### **5.1. Key Conclusions**

- Representative sampling successfully characterized multiple mineral by-product streams.
- Two mineral streams qualify as Supplementary Cementitious Materials for cement and concrete applications.
- The waste stream presents opportunities for alternative beneficial uses.
- Multiple commercial markets exist for the evaluated materials.

### **5.2. Recommendations**

PEC Consulting's recommendations for the client included:

- Continuing discussions with prospective buyers.
- Evaluating any additional processing required to meet market specifications.
- Reviewing material handling and loading infrastructure.
- Performing routine quality-control testing of future production.
- Testing stockpiled materials independently before commercialization.

### **5.3. Benefits of Implementation**

Manufacturers who successfully repurpose mineral by-products can realize significant operational, environmental, and financial benefits, including:

- Reduced landfill disposal.
- Improved sustainability performance.
- Lower environmental footprint.
- New revenue opportunities.
- Greater resource efficiency.
- Support for circular economy initiatives.

## **ABOUT THE AUTHOR(S)**

### **Dario Hadziselimovic**

Dario Hadziselimovic is a Principal Consultant with PEC Consulting Group with more than 25 years of experience in plant design, mechanical engineering, project management, and industrial consulting. He advises clients in the cement, lime, mining, industrial minerals, recycling, and bulk material handling industries.

Previously, he served as Chief Mechanical Engineer at PENTA Engineering Corp., leading multidisciplinary engineering teams on domestic and international projects. He holds a Bachelor of Science in Mechanical Engineering from the University of Missouri–St. Louis, is a registered Professional Engineer (P.E.), and certified Project Management Professional (PMP).

PEC Consulting Group LLC | PENTA Engineering Corporation | St. Louis, Missouri, USA