


Product

High-quality Portland cement since 1907 with a capacity of over 1.7 million tons of cement annually,

Location

Plants in Sugar Creek, MO, and Tulsa, OK

Parent Company
Subsidiary of Eagle Materials Inc.



Market
Serving Arkansas, Kansas, Missouri, Oklahoma, Iowa, and Nebraska.

Problem Statement

The current layout presents several challenges in optimizing the management of stockpiles for raw materials, fuel, and intermediate products. Specific issues include inefficient material flow, inefficient routing of materials to processing lines, and overall operational efficiency. Additionally, the plant lacks a comprehensive system to determine ideal stockpile sizes, possibly leading to excess or insufficient material stockpiles which disrupts production, or to excess holding costs due to unnecessarily large stockpiles.

Methodology

Material Flow Optimization: Using Mixed Integer Linear Programming (MILP).

- Can assign stockpile to any location.
- Assigns locations with the goal of minimizing total travel times from piles to feed points
- **Stockpile Management:** Economic Order Quantity (EOQ) model with safety stock to mitigate disruptions and ensure smooth production flow.
- **Spaghetti Diagram:** Visualize material movement and plant layout.

$$EOQ = \sqrt{\frac{2DS}{H}}$$

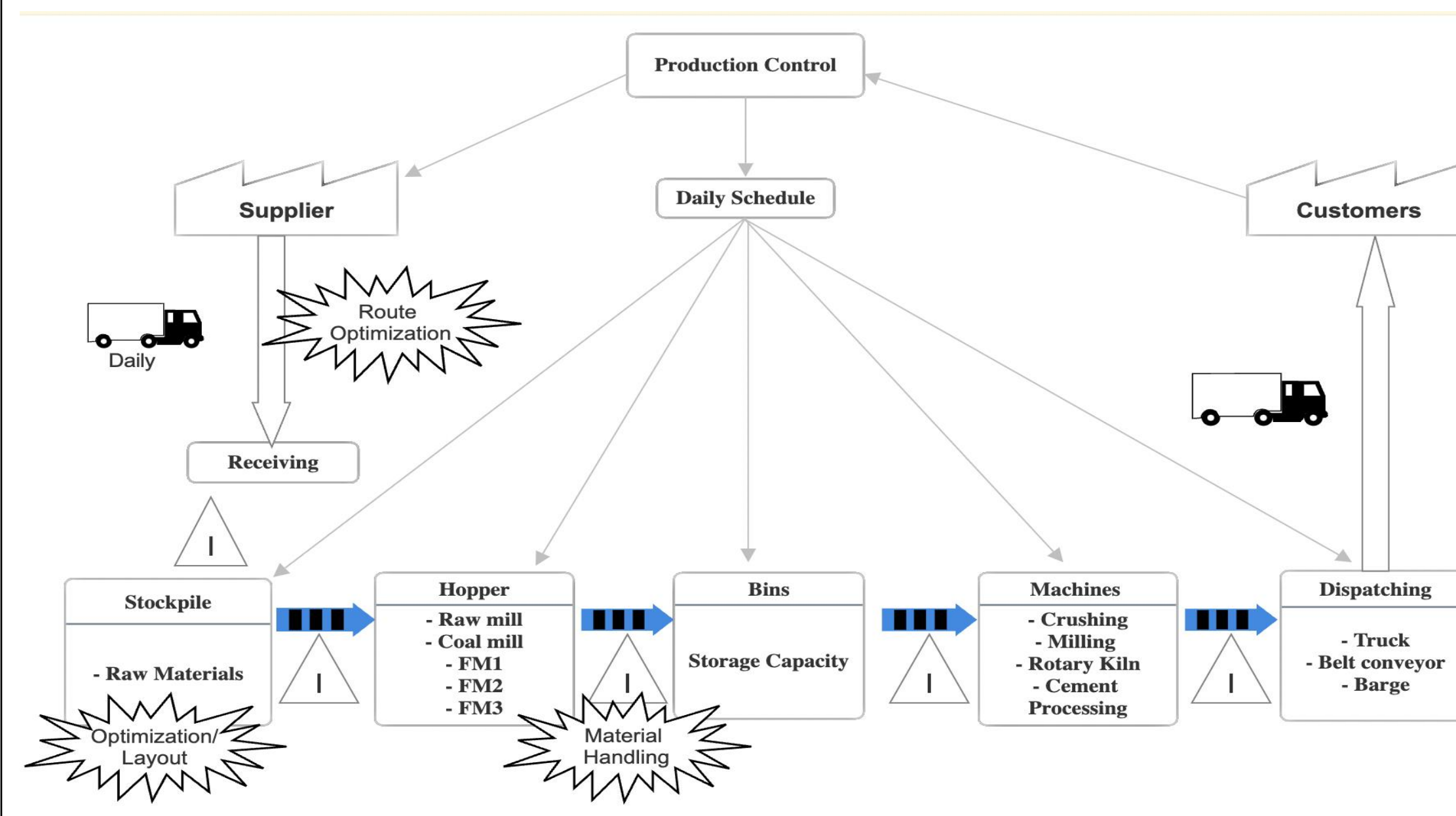


Figure 1. Conceptual Model

Results

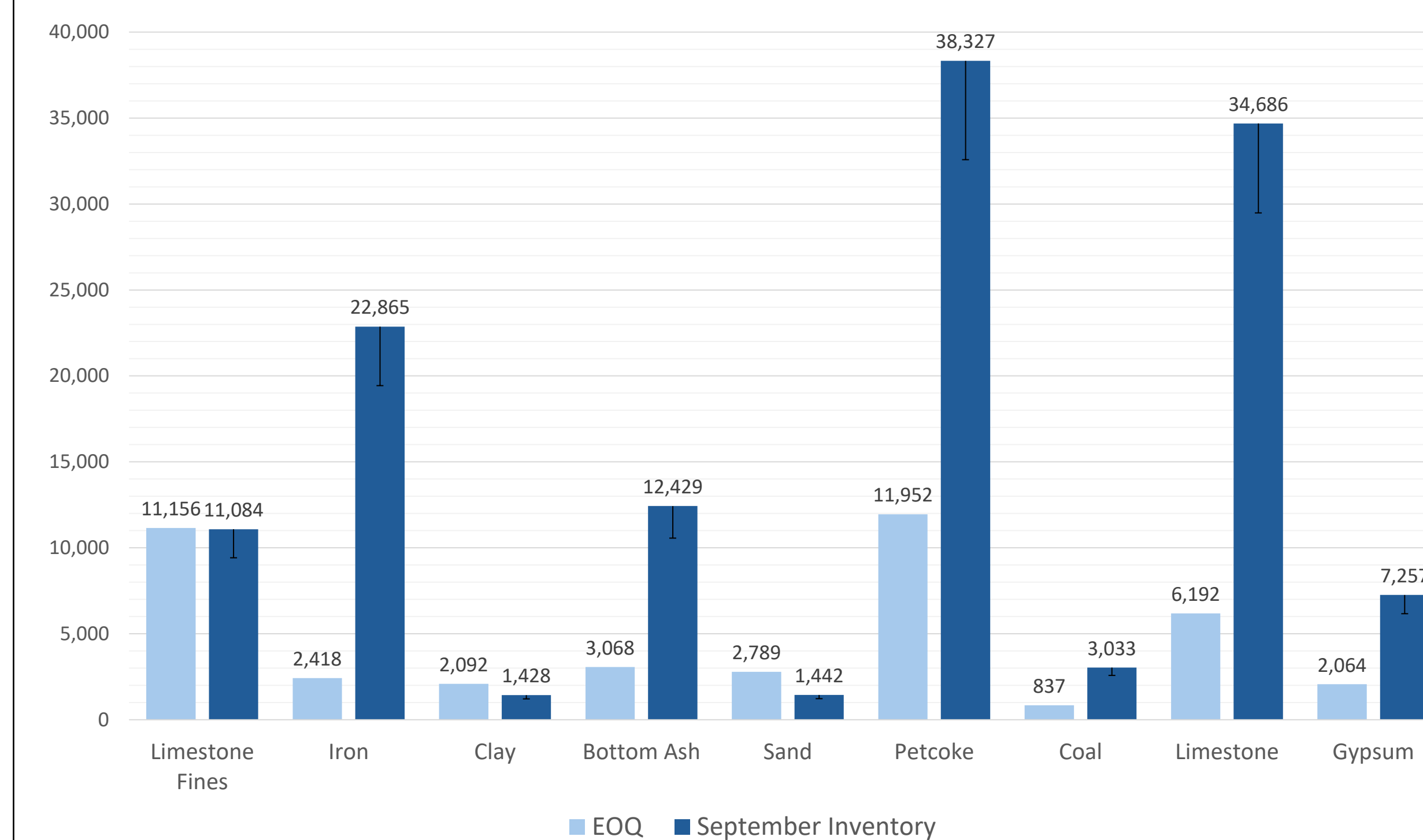


Figure 2. EOQ vs September Inventory

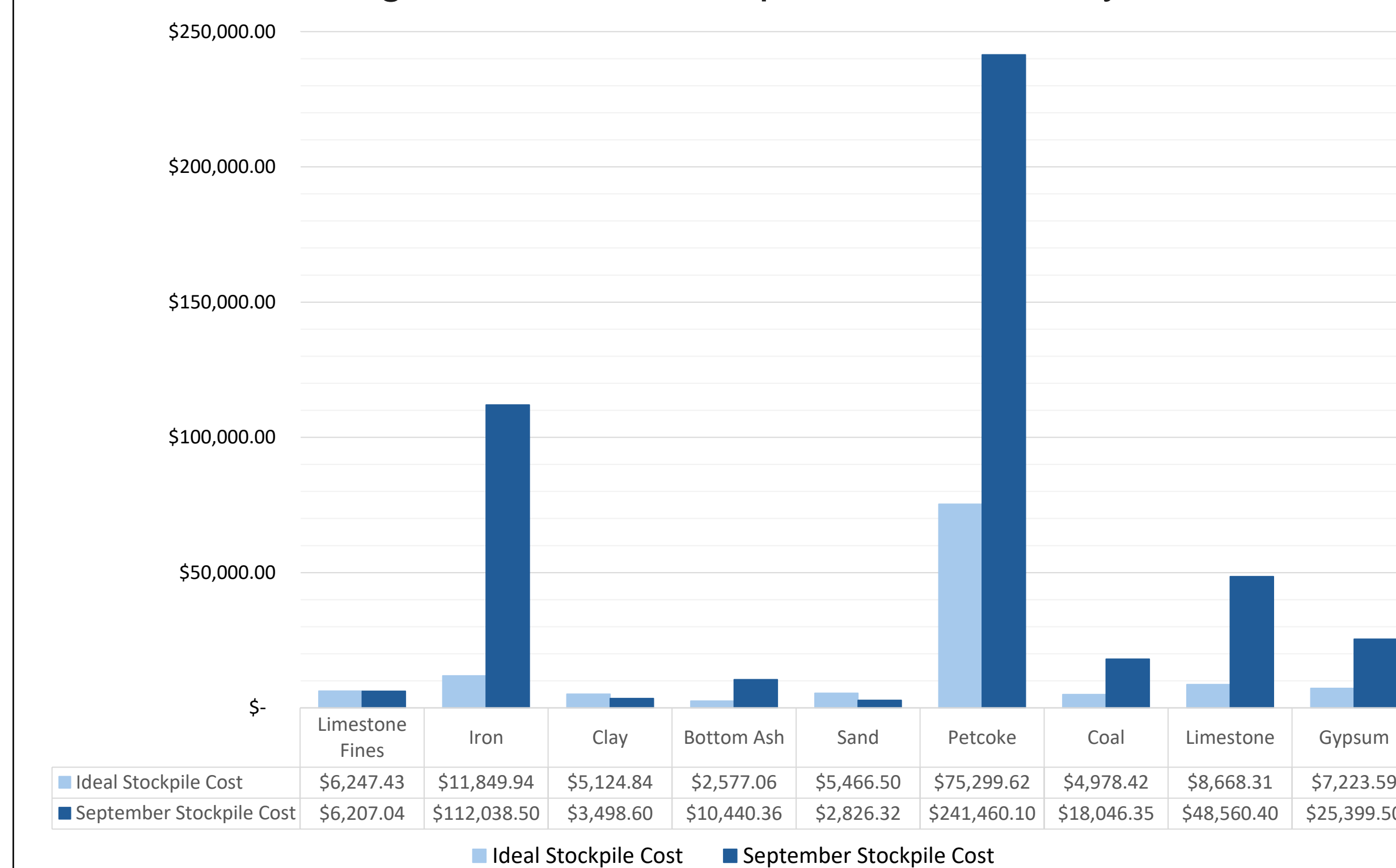


Figure 3. Cost per Stockpile

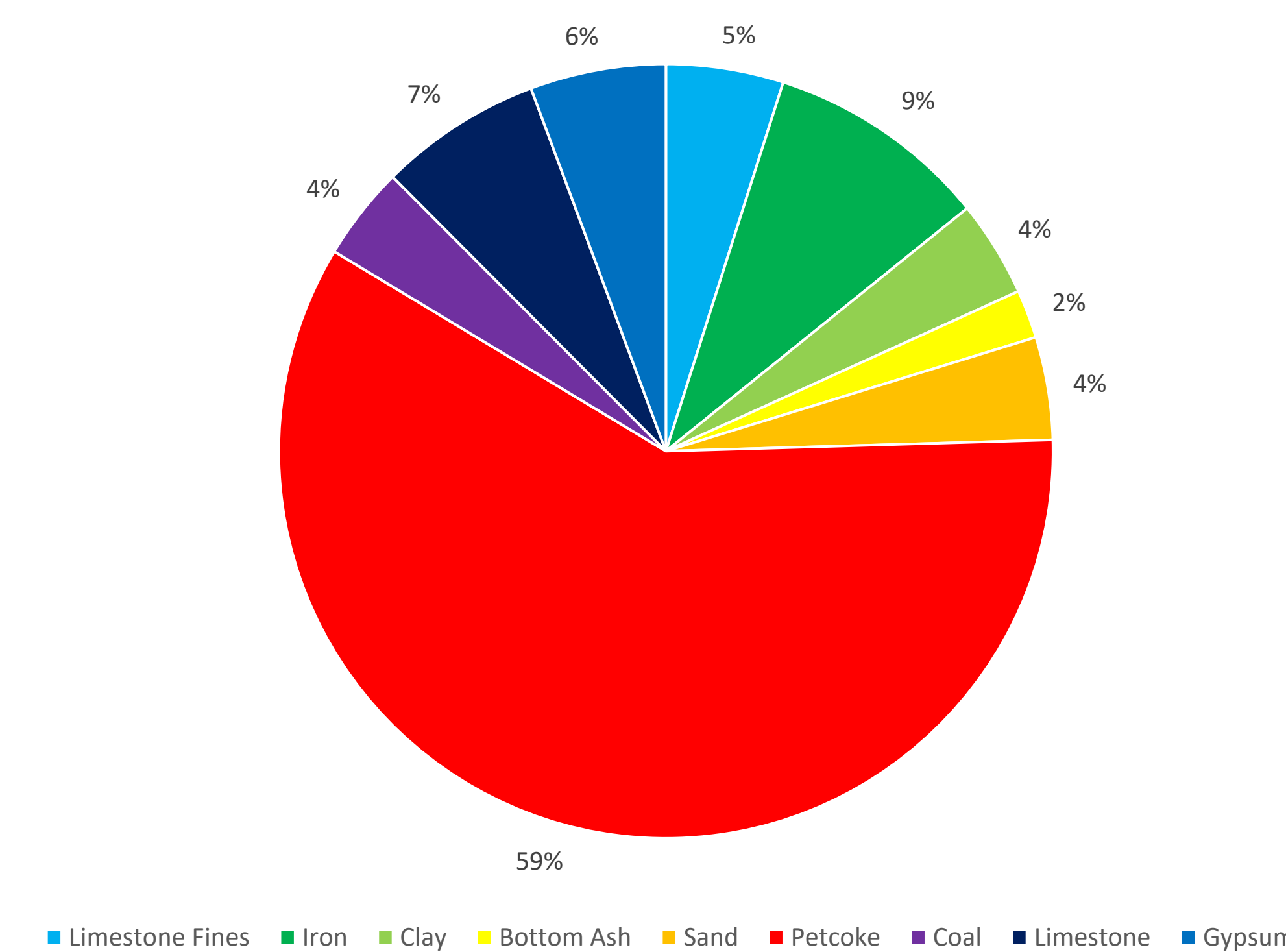


Figure 4. Optimized Material Distribution

- Immediate one-time savings of **\$2.5 million** with ongoing annual savings of **\$341,000** in holding costs by reducing the stockpile sizes.

- Reduce pet-coke inventory from **\$3.5 million (52% of total)** to **\$1.075 million (59%)** and iron inventory from **\$1.6 million (24% of total)** to **\$170,000 (9%)**.

- Many of the stockpiles already follow the optimal plant layout.

- Potential layout changes were identified, including moving and consolidating piles, clearing area for new piles, and creating new roads.

- **\$7,000 annual savings** due to a reduction in equipment usage.

- **\$13,000 annual savings** by constructing a new road, dependent on the new AB3 pile location

- Recommendations are limited to three pile consolidations and two pile relocations.

- No new piles are recommended for lack of candidate locations and the benefits not justifying the large area clearing costs.

Discussion

Benefits:

- Improved operational efficiency.
- Reduced material handling cost.
- Reduced raw material holding costs without risking shortages.

Challenges:

- Limited options for new stockpile locations
- Accurate data collection for stockpile size determination.

