Trusted partners delivering aggregates, minerals, reliable fuels, and environmental solutions.
Precision Mining Tools

Ore Control
GPS
Surface Miners
Ore Control

• Drilling or Channel Sampling
  • Supplements exploration drilling
  • Incremental sampling and selective sampling to identify low grade zones

• Use of hand held scanners
  • XRF/LIBS

• Data incorporated into short-range model and planning
GPS

• Grids are developed from the short-range model, previous pit surveys, in-pit ore control data, and fault mapping

• GPS mounted to the top of all dozers, supervisor trucks, and side-by-side
Wirtgen 4200 Surface Miner

- Slewing ring
- Conveyor counterweight
- Drive unit with diesel engine
- Operator's cabin
- Slewing and height-adjustable discharge conveyor
- Height-adjustable crawler track
- Scraper blade with primary conveyor
- Mechanically driven cutting drum
- Steered and height-adjustable crawler track
- Camera
- Working direction
Bisti Fuel Study

- In 2017 at Navajo Mine near Farmington, NM, NACoal successfully transitioned coal loading fleets from conventional dozer/loaders to surface miners
- For seam 2, heating value improved from 9,050 to 9,300 BTU/lb and ash content from 22% to 16%

**Original Option (Seam 2) - Ripping with Dozers**

- Delivered Product (Pre-Dilution): Coal: 9,300 BTU, 16% ash
- Parting: 5,286 BTU, 45% ash
- Composite Ash: 22%
- Composite BTU: 9,050

**Final Solution (Seam 2) - Wirtgen 4200 Surface Miner**

- Delivered Product (Pre-Dilution): Coal: 9,300 BTU, 16% ash
- Parting: 5,286 BTU, 45% ash
- Ash: 45%
- BTU: 5,286

**Overall Delivered Quality**

- Annual Deliveries (million tons)
- Heating Value (BTU/lb)
Red Hills Mine Study

- NACoal successfully transitioned the coal recovery process at Red Hills from conventional hydraulic excavator to Surface Miners
  - Power Plant designed to handle up to 23%
  - Original mine target for ash was 20% (There was no need to separate parting)
  - After operations started, the plant was forced to derate when ash exceeded 18% due to ash handling systems
- The transition to a surface miner recovery method eliminated the need to derate the plant due to ash content

**Original Option (F-seam) – hydraulic excavator**

- F2 Rider Seam: 12% ash
- Parting: 42% ash
- F Seam: 12% ash

Original Mine Plan employed Whole-Seam Mining which resulted in contract compliant ash of ~20%

**Final Solution (Seam 2) – Wirtgen 4200 Surface Miner**

- F2 Rider Seam
- Reject Parting
- F Seam

Red Hills began selectively mining the F- Seam to reduce ash to ~16% in direct response to power plant needs and at increased cost to NAC.

- Additionally, the installation of gamma detectors improved the process by selectively mining the coal seams by ash content (approx. 3% incremental reduction of ash content)
Gamma Ray Detector

- The gamma detector is also known as the clay/coal avoidance system
  - Detects variances in gamma radiation between coal and carbonaceous clays
  - Real-time information is transmitted to an in-cab monitor
  - Monitor displays a percentage of ash content
  - Precise gamma differences enable the operator to accurately follow the coal floor

- Original system developed by Geosteering Mining Services
  - Red Hills Mine provided the testing environment and operator feedback
  - Gamma detector box is a self contained unit
  - Very little maintenance is required
  - Replacement is every 2+ years

- Since installation in 2010
  - 3% improvement in overall recovery
  - Coal quality has consistently improved

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Ash (%)</th>
<th>Total Recovery</th>
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<tr>
<td>2008</td>
<td>15.9%</td>
<td>86.7%</td>
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<tr>
<td>2009</td>
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<tr>
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<td>2011</td>
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<tr>
<td>2015</td>
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