Engineered Transfer Chute Technology
Air Flow Analysis and Dust Mitigation

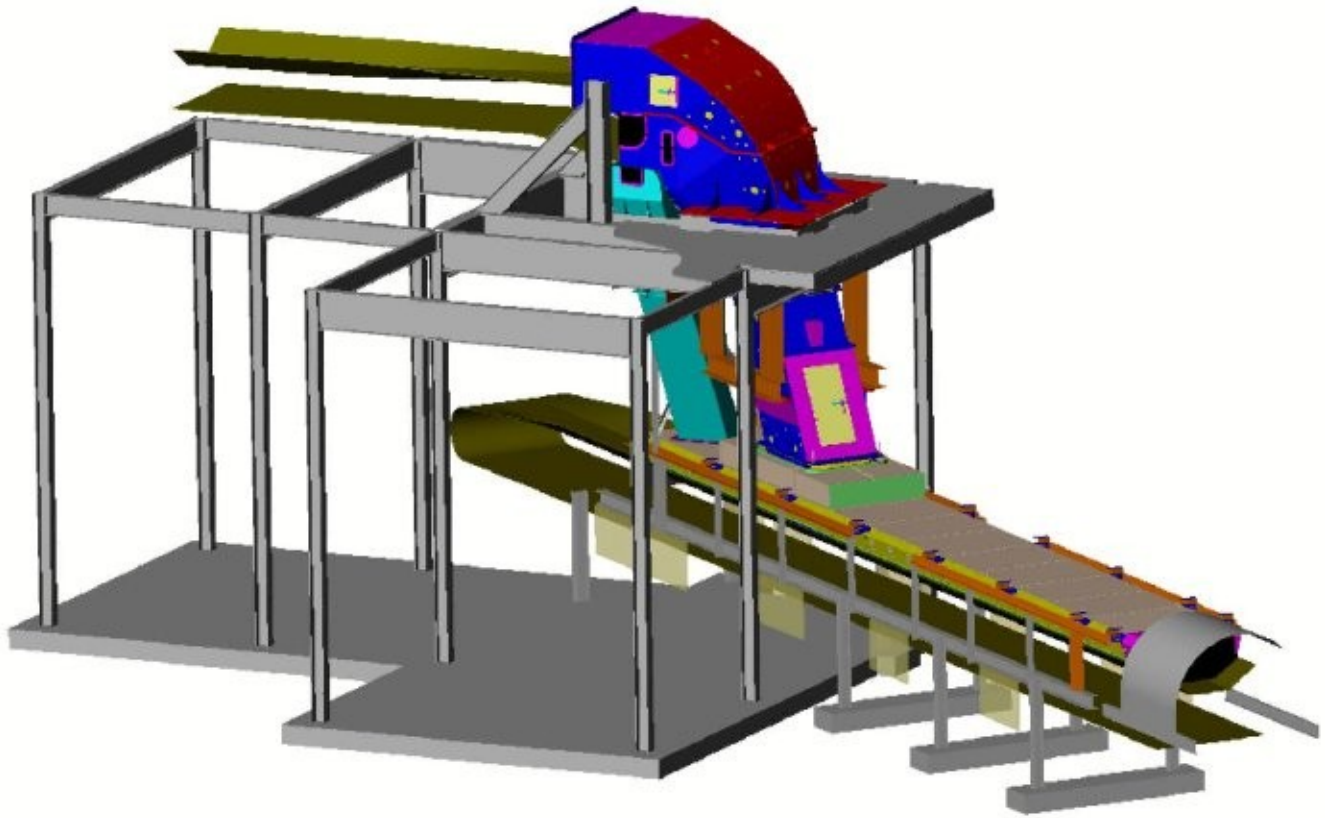
Dr. Kevin Linfield, P.E.
Airflow Sciences Corporation
Livonia, MI

Matthew Koca
Flexco Engineered Systems Group
Bolingbrook, IL

Transfer Chute Replacement - Project Description

- Rio Tinto North Antelope Mine, Near Gillette, WY
- Powder River Basin Coal
- One-to-One Belt Transfer
  - CV5 belt feeding onto CV6 belt
  - 72” Wide Belts at 1100 fpm
  - 6600 tons per hour capacity
- Eliminate Baghouse Dust Collector
- Subject to Regulatory Dust Opacity Testing

Transfer Chute Replacement - 3D Model



Transfer Chute Replacement - Installed

Transfer Chute Replacement - Initial Results

- Tonnage Requirements Achieved
- Spillage Requirements Achieved
- Dust Levels Not Acceptable
- Inconsistent Dust Levels
- Failed Regulatory Opacity Test

Transfer Chute Replacement - Course Of Action

- Existing Applications Using Similar Designs Did Not Exhibit High Levels Of Dust
- Extend Skirting From Load Point To 3/4 Belt Covers
- Add Staggered Rubber Baffles Inside Skirting To Knock Down Any Airborne Dust

Transfer Chute Replacement - Results of Skirting Extension

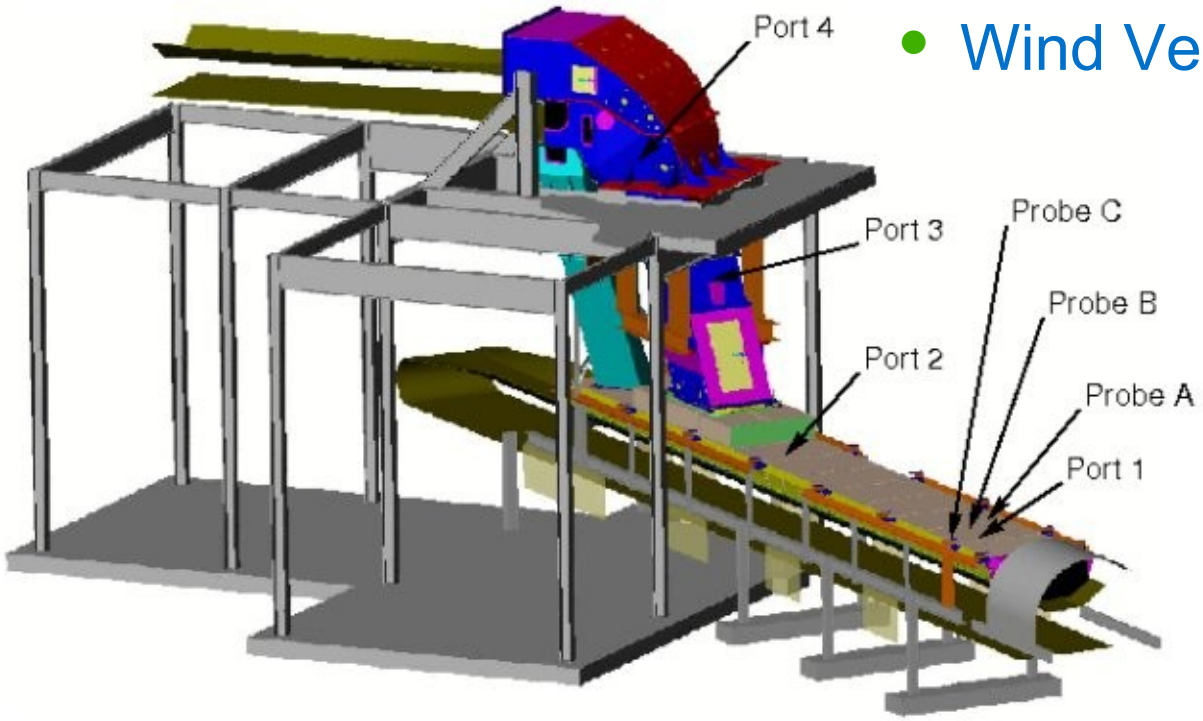
- Still Experiencing Dusting At Exit Of Skirting
- Still Fails Opacity Test

Transfer Chute Replacement - Find Cause Of Dust Generation

- Contract Airflow Sciences Corporation to Analyze Air Flow at Transfer Chute

Field Inspections

- Field Measurements
  - Dirty Air Velocity (3 locations)
  - Static Pressure (4 locations)
  - Wind Velocity & Direction



Field Test Results

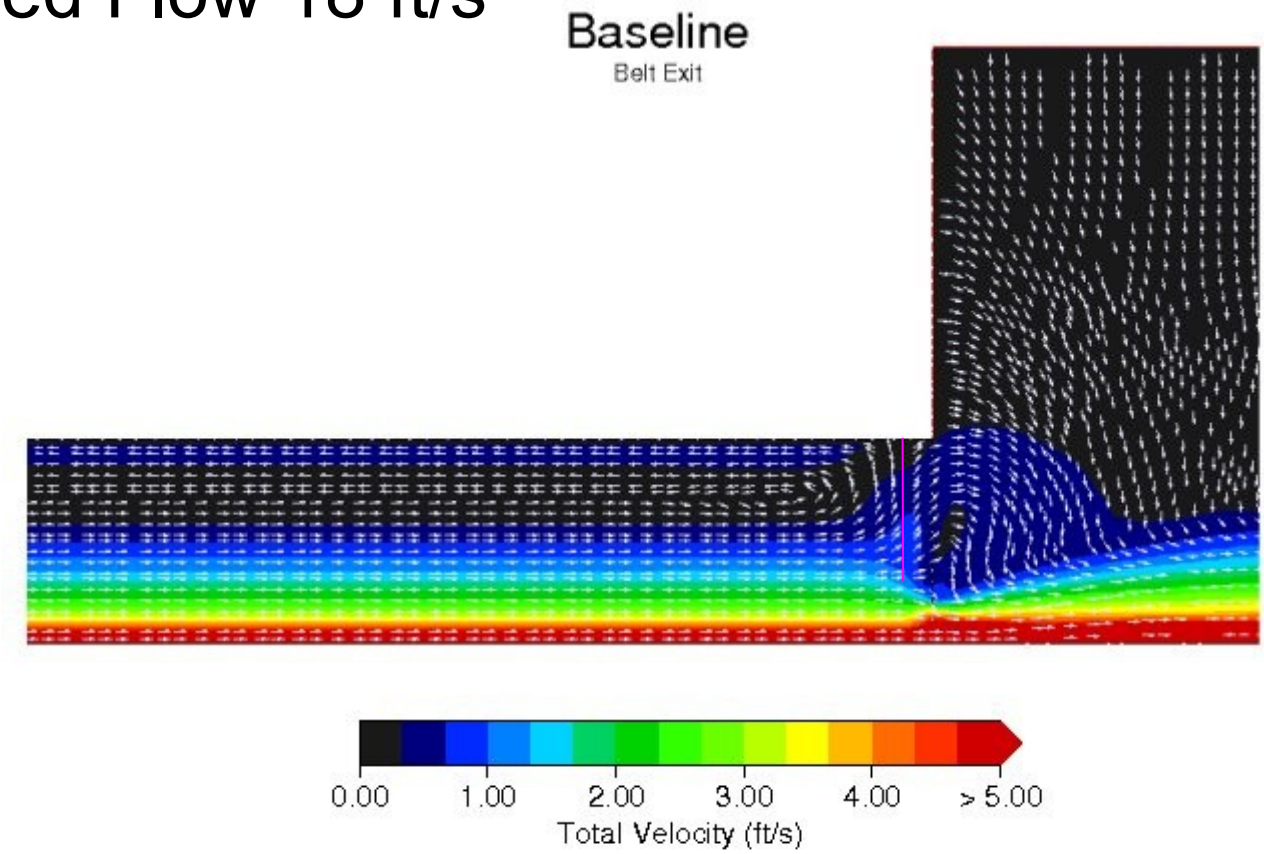
- Measured Velocity the Same With Belt On or Off at Outlet of Skirting (10 ft/s)
- Measured Velocities Less Than 5 ft/s Inside the Skirting
- Wind Velocity 30 ft/s (21 mph) Around Skirting
- Max Static Pressure Measured in Transfer System ~0.01 IWC

CFD Flow Study

- Flow Induced by Belt
- Flow Induced by Wind

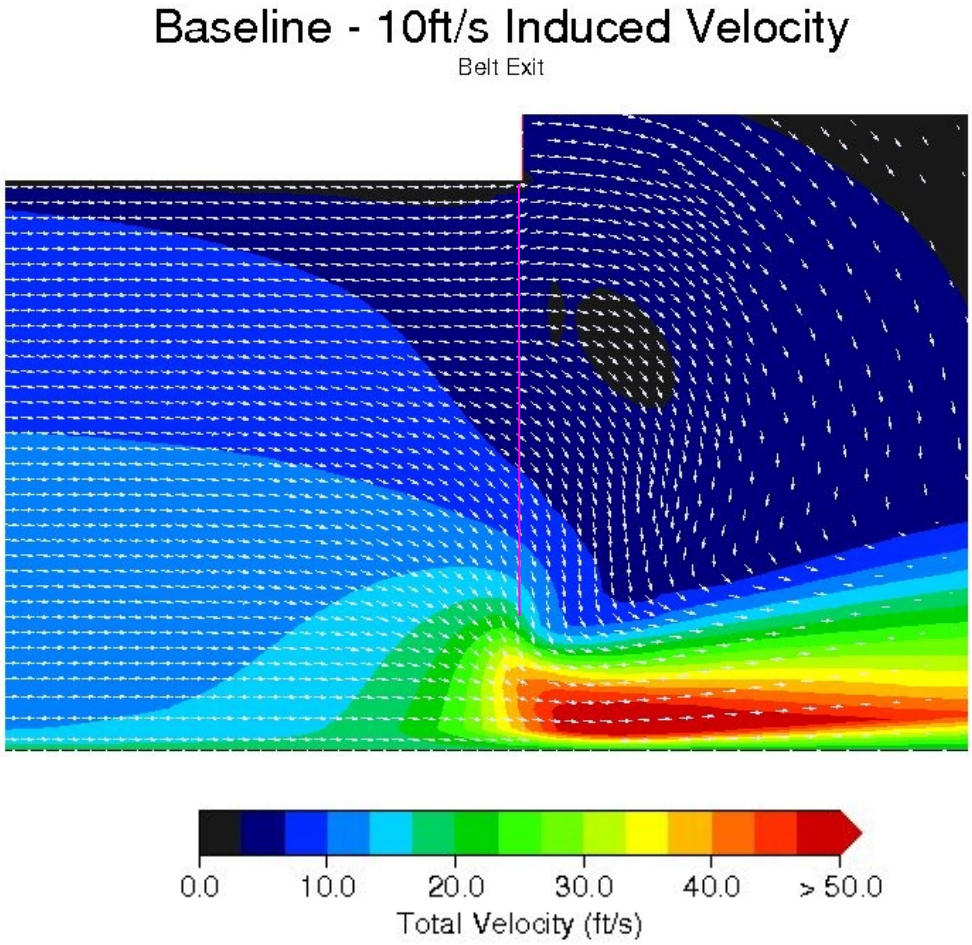
Belt-Driven Flow Field

- Max Induced Flow 18 ft/s



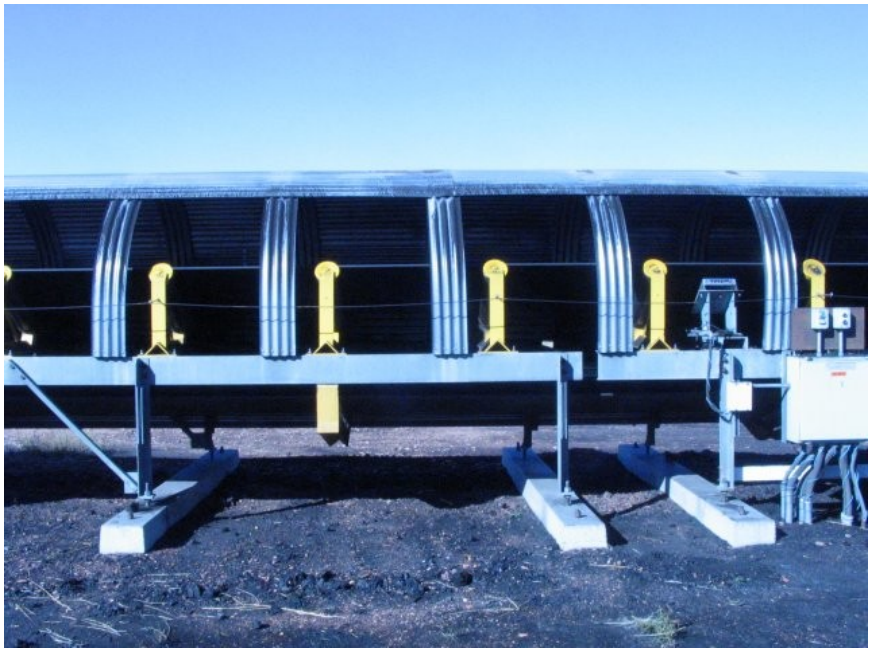
Wind Induced Flow Field

- Stationary Belt
- Determined 30 mph Wind Induces up to 25 ft/s Flow in System (10 ft/s Average)
- Maximum Exit Velocity 54 ft/s



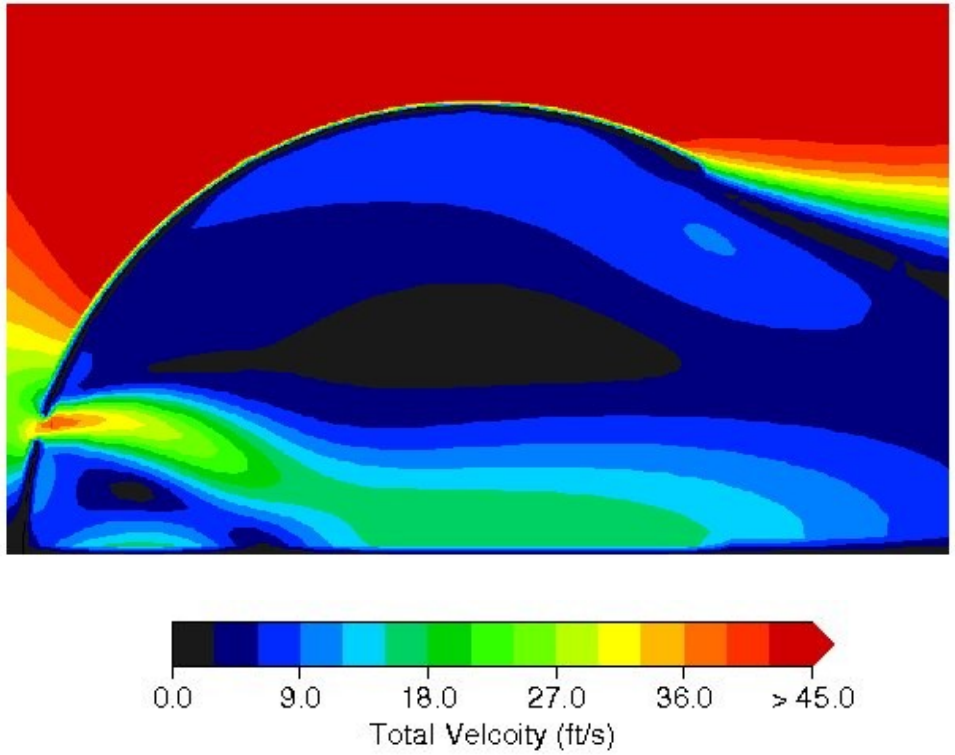
Corrugated Cover

- Noted Dust on Cover



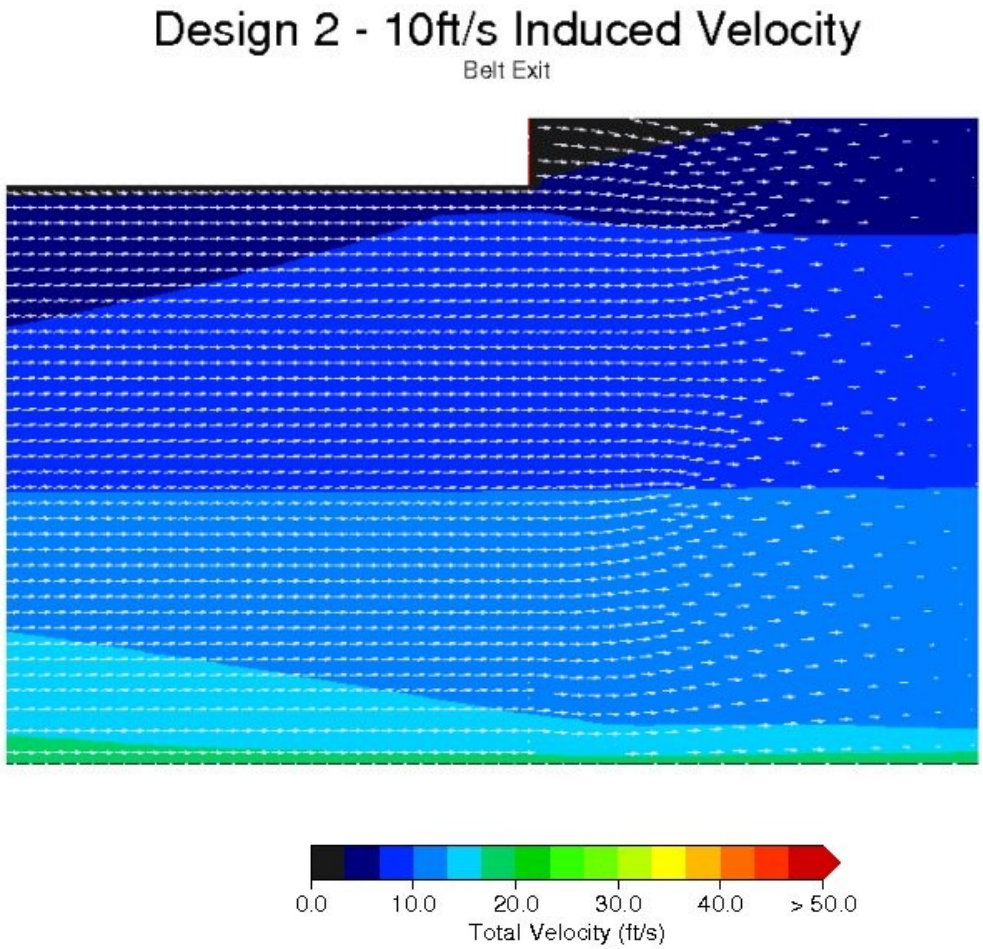
Corrugated Cover Model Results

- Assumed 25 mph Cross Wind
- 40 ft/s Flow Through Gap
- ~20 ft/s Flow Over Belt



Select Design Results

- Revised Exit Skirting
  - Remove Rubber Curtain at Exit of Skirting
  - Eliminate High Velocity Jet



Summary

- Performed Field Testing & CFD Flow Modeling on Transfer Chute
- Determined Wind Effects Cause for Coal Dust Ejection
- Determined Numerous Designs to Reduce or Eliminate Coal Ejection
- Solution Was to Remove High Speed Jet at Exit

Questions?

- For More Information Contact:

- Airflow Sciences Corporation
  Dr. Kevin Linfield, P.E.
  Phone: (734) 525-0300
  Email: klinfield@airflowsciences.com
- Flexco Engineered Systems Group
  Matt Koca - Application Engineer
  Phone: (815) 609-7025
  Email: mkoca@flexco.com