

Wet-To-Dry Conversion
Bottom Ash & Fly Ash Systems



Wet-To-Dry

Ash Handling Solutions

The Evolution to Dry Ash Handling

Recent high-profile incidents surrounding ash pond failures are forcing coal power plants to re-evaluate wet ash handling practices. Utility companies still using ash retention ponds to store ash by-product have important choices as they look to replace wet systems with dry solutions. Over the past few decades United Conveyor Corporation (UCC) has assisted many utilities in converting from wet fly ash to dry systems based on these market trends and factors:

- In conjunction with the Powder River Basin fuel-switching initiatives
- As local markets emerged, enabling the reuse and sale of fly ash to concrete suppliers
- To extend the pond life for bottom ash storage of capacity-constrained ponds.

As of 2008, nearly 67% of plants with ash ponds have converted to dry fly ash systems, while only 10% of bottom ash systems are dry.



INDUSTRY TRENDS

- INCREASING GOVERNMENT REGULATIONS
- ASH POND CAPACITY CONSTRAINTS
- WATER AVAILABILITY
- GROWING DEMAND FOR REUSE OF ASH

Public scrutiny, environmental concerns and pending government regulations may further shift the industry to dry or reduced water consumption alternatives. Increased focus on converting wet bottom ash systems is expected to eliminate legacy ash ponds. State-of-the-art ash handling systems from UCC offer greater equipment reliability and the broadest range of customized solutions to better serve removal operations.

What is “Dry”?

“Dry” is often used in the industry to represent placement into a landfill, not necessarily the method of conveying. The objective for most utilities is to eliminate the pond – not always the use of water from the ash conveying process for fly and bottom ash. However, some plants will need to minimize or eliminate water from the conveying process due to limited water supply or environmental concerns. These conditions frame the available choices, which range from continued use of water to 100% elimination of water.



Experience Matters

United Conveyor Corporation is dedicated to the development of technology, systems and products that address the needs of coal-fired power plants. As a recognized industry leader, we partner with utilities, design engineering firms and power generation companies worldwide to help deliver solutions that make a positive impact on plant performance.

Since 1920, UCC has set the standard for innovation, performance and customer service. We have the broadest offering in fly and bottom ash systems to deliver the right solution and optimal performance for your plant.



UCC ASH HANDLING SOLUTIONS ARE...

- SPECIFICALLY ENGINEERED FOR EACH PLANT
- DESIGNED TO IMPROVE PLANT PERFORMANCE
- ENVIRONMENTALLY FRIENDLY SOLUTIONS

One Company...*the Right Solution*

Fly Ash Systems

- Vacuum Systems (NUVEYOR®)
- Pressure Systems (NUVA FEEDER®, DEPAC® and MultiDAC™)
- Combination Vacuum/Pressure Systems
- High Density Slurry System

Bottom Ash Systems

- Recirculation Systems
- Submerged Flight Conveyors (SFC™)
- Pneumatic Ash Extractors (PAX™)
- Vibrating Ash Extractors (VAX™)



Fly Ash System

Fly Ash Choices

Conversion Utilizes Existing Hydroveyor® Vacuum System

Dry fly ash conveying has become the standard for new installations and retrofits over the last few decades. Since 1920, UCC has engineered thousands of fly ash installations in over 50 countries. Retrofitting an existing wet HYDROVEYOR® system into a dry fly ash system is completed with the addition of a few system components.

Using our technical experience, breadth of systems and products, UCC works directly with customers to find the right solution to address current and future environmental regulation requirements. The options include the NUVEYOR® Vacuum System, Combination Vacuum/Pressure System (NUVA FEEDER® for medium phase or DEPAC® for dense phase materials) or Pressure System.

There are several factors to analyze when deciding which of the dry fly ash solutions would be the best choice for the plant.



Common Criteria Used to Evaluate Fly Ash Choices:

- Current and Future Fuel – Are any fuel changes planned?
- Existing Pipe – What is the size and routing?
- Headroom – How much headroom is available under the hoppers?
- Vacuum/Pressure Transfer Station – If required, where is it located?
- Location – Where will the final storage silo be located?
- Distance/Routing – How far to the final disposal point/silo?
- Capacity – What is the ash generation rate and how many days of storage is required?
- Final Disposal Method – Will the ash be disposed of conditioned or dry?
- Aftermarket Considerations – What are the ash marketing/resale considerations?

Fly Ash Systems	NUVEYOR® (Vacuum)	NUVA FEEDER® (Pressure)	DEPAC® (Pressure)	MultiDAC™ (Pressure)
Phase	Dilute	Medium	Dense	Dense
Maximum Distance	1500 feet (450 meters)	8000 feet (2400 meters)	5200 feet (1600 meters)	1500 feet (450 meters)
Maximum Capacity	80 TPH (75 mTPH)	175 TPH (155 mTPH)	200 TPH (180 mTPH)	130 TPH (120 mTPH)
Material Ratio	5-22 Ash : Air	5-22 Ash : Air	25-60 Ash : Air	25-60 Ash : Air
Air Velocity	3000-5200 ft/min (16-27 m/sec)	2400-4800 ft/min (12-25 m/sec)	900-2700 ft/min (5-15 m/sec)	900-2700 ft/min (5-15 m/sec)
Maximum Conveyor Line Pressure	20 inches Hg (530 mm Hg)	40 psi (275 kPa)	60 psi (415 kPa)	60 psi (415 kPa)

NUMBER OF INSTALLATIONS

NUVEYOR – **2000+** DEPAC – **400+**
 NUVA FEEDER – **1000+** MultiDAC – **50+**

Vacuum System

The NUVEYOR vacuum fly ash system is the industry standard for efficient, reliable ash removal up to a distance of 1500 ft. (450m) and installed capacities up to 80 TPH. When converting from wet-to-dry fly ash conveying, the existing vacuum equipment is typically reused to reduce costs.

The addition of a few system modifications is all that is required:

- Filter/Separator
- Storage Bins and Unloading Equipment
- Mechanical Exhauster or Vacuum Pumps
- New Yard and Silo Connection Piping

Vacuum System with Silo



NUVEYOR SYSTEM

- REUSE EXISTING VACUUM SYSTEM
- EASE OF RETROFIT IN LIMITED SPACE



Combination Vacuum/Pressure Systems

Combination vacuum/pressure systems are used when the conveying distance exceeds the capabilities of a vacuum system. The system continues to take advantage of the simplicity and lower cost of existing vacuum intakes beneath the ash collectors, while providing the benefits of a pressure system – high capacity and long distance conveying to remote dry storage bins. In a vacuum/pressure system, an exhauster creates the airstream to convey fly ash from the precipitator or other collection hoppers to a transfer tank. From that point, a NUVA FEEDER or a DEPAC system is used to move the ash to a storage silo.

Pressure Systems

With sufficient headroom under the collection hoppers, the existing vacuum system can be replaced with a NUVA FEEDER, DEPAC or MultiDAC system, eliminating the need for intermediate transfer tanks.



Filter/Separator to Pressure System



DEPAC SYSTEM

- DENSE PHASE - LOW VELOCITY

Bottom Ash Choices

Choosing The Right Dry Bottom Ash System

United Conveyor offers the broadest range of state-of-the-art dry bottom ash handling solutions. Four different system types – Hydraulic, Mechanical, Pneumatic and Vibratory – have been developed to address the particular characteristics of each individual power plant. With hundreds of installations and nearly 90 years of experience, UCC provides the confidence and peace of mind our customers demand.

Each plant must evaluate the importance of different criteria when selecting the right bottom ash system.

Common Criteria Used to Evaluate Bottom Ash Choices:

- Physical Space Constraints – What system choices are available?
- Design, Material and Installation Costs – What is the budget?
- Maintenance Costs – What is the 20-year life-cycle cost?
- Time Available for Installation – How long is the outage?
- Water Usage/Availability – How much water is available for ash conveying and disposal?
- Operating Costs – What are the power consumption requirements?
- Multiple Unit Synergies – Can storage tanks and silos be used for multiple units?
- Storage/Disposal – How will the bottom ash be stored/used?



Bottom Ash Systems		Recirculation (Hydraulic)	SFC (Mechanical)	PAX (Pneumatic)	VAX (Vibratory)
Total Installed Cost		\$\$\$\$	\$	\$\$	\$\$\$
Lead Time		9 months	9 months	12 months	12 months
Outage Requirement	Pre-Outage Construction	6 months	2 months	3 months	3 months
	Outage Construction	5 days	3 – 4 weeks	8 weeks	6 weeks
	Outage Start-Up	2 – 3 days	1 – 2 days	3 – 4 days	1 – 2 days
Water Consumption	Make-Up Water	600 gpm	50 gpm	None	None
	Cooling Water	200 gpm	400 gpm	None	None
	Conveying Water (recirculating)	400 gpm	None	None	None
Power Consumption	Pumps	600 HP	50 HP	None	None
	Blowers/Fans	None	None	200 HP	50 HP
	Mechanical Drives	50 HP	100 HP	50 HP	75 HP
Boiler and Yard Space	Yard Piping Corridor	Yes	No	Yes	No
	Boiler House Exit Corridor	No	Yes	No	Yes
	Yard Footprint	6500 sq. ft.	1000 sq. ft.	1500 sq. ft.	1500 sq. ft.
Operations and Maintenance Costs	Pumps	Yes	No	No	No
	Blowers/Fans	No	No	Yes	Yes
	Refractory	Yes – existing	Usually none	Yes	Usually none
	Conveyor Chain Replacement	No	Yes	No	No
	Crushers	Yes – existing	Usually none	Yes (2 – 3)	Yes (1)
	Conveying Pipeline/Valves	Yes	No	Yes	No

Table information based on typical installation.

Systems

BOTTOM ASH SYSTEMS

- RECIRCULATION SYSTEM
- SUBMERGED FLIGHT CONVEYOR (SFC™)
- PNEUMATIC ASH EXTRACTOR (PAX™)
- VIBRATORY ASH EXTRACTOR (VAX™)



There will be certain plant limitations that will quickly reduce the choices to one or two options. For example, if the ash pond needs to be eliminated in the next 12-24 months and there is no chance of a several-week unit outage to replace equipment, the only choice becomes a Hydraulic Recirculation System. If 100% elimination of water is required, then there are only two options: pneumatic conveying (PAX) and vibratory conveying (VAX).

NUMBER OF INSTALLATIONS

RECIRCULATION SYSTEM	75+
SUBMERGED FLIGHT CONVEYOR	100+
PNEUMATIC ASH EXTRACTOR	200+
HEAVY-DUTY HOT INDUSTRIAL APPLICATIONS UTILIZING VIBRATORY TECHNOLOGY	1,000+

Bottom Ash

Recirculation System

Simple Conversion with a Successful Track Record

A Recirculation System converts a wet sluice system into a “dry” ash system without change to the existing bottom ash hoppers. This system reuses the conveying water and only requires a small amount of make-up water. A complete recirculation system replaces the ash pond with dewatering bins, a clarifying (settling) tank and surge (storage) tank.

This is the system of choice when water supplies are available and minimal outage time is required to make the conversion. Once the system components have been installed, the Recirculation System only requires a few days of outage time to reroute the pipes.



- SHORTEST OUTAGE TIME FOR CONVERSION
- CONTINUED USE OF EXISTING BOTTOM ASH HOPPERS
- EASILY INCORPORATES MILL REJECTS
- ELIMINATES ASH STORAGE PONDS

System Operation

In a typical system, two dewatering bins are required; one bin fills while the other is dewatered and unloaded into trucks or rail cars. Water overflows to the settling tank and then onto the surge tank. In the settling tank, a large percentage of the fine ash carryover settles to the bottom and is returned to the dewatering bin.

Water leaving the settling tank is directed to the surge tank where recirculation pumps return the water to the existing bottom ash sluice system.



Systems

Submerged Flight Conveyor (SFC™)

The Industry Leader with Proven Performance

The Submerged Flight Conveyor (SFC) is a proven bottom ash system and the most cost-effective choice when compatible with the plant equipment layout. When reducing water consumption is a major deciding factor, the typical SFC system provides the lowest cost option. With installations operating around the world, this system has demonstrated proven performance and reliability.

The conveyor is manufactured in various standard widths, making it easily adaptable to many boiler sizes. The SFC system is compatible with pulverized coal-fired (PC) boilers, wet bottom (slagging) boilers, stoker-fed or traveling gate boilers and incinerators.

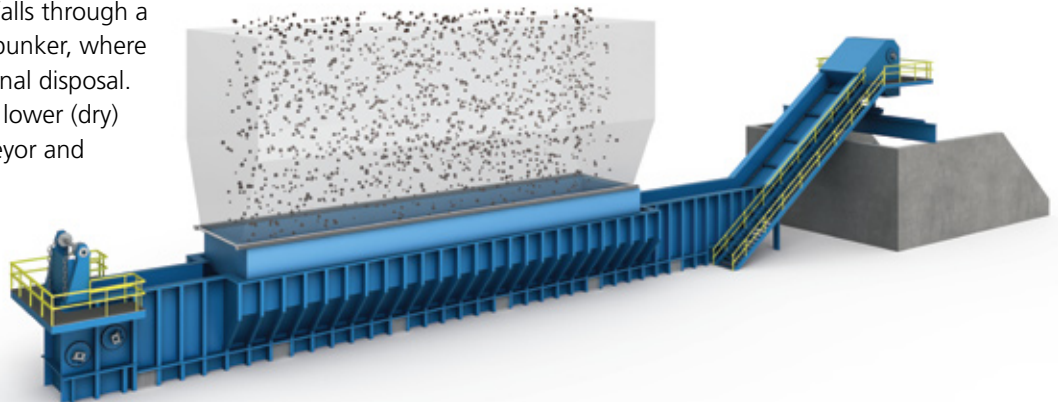


- CONTINUOUS REMOVAL OF ASH
- LOW POWER CONSUMPTION
- EASILY INCORPORATES MILL REJECTS
- ELIMINATES ASH STORAGE PONDS

System Operation

Operation of the Submerged Flight Conveyor is very simple. Ash falls from the boiler into a water-filled, upper trough that quenches and cools the ash. Chains and flights move the ash along the horizontal trough and up a dewatering ramp.

At the top of the ramp, the ash falls through a discharge chute into a concrete bunker, where it can be loaded into trucks for final disposal. The flights continue through the lower (dry) chamber to the rear of the conveyor and then return to the upper trough.



Bottom Ash

Pneumatic Ash Extractor (PAX™)

Time Proven Technology with Routing Flexibility

The Pneumatic Ash Extractor (PAX) System is the preferred retrofit system to overcome structural barriers when complete elimination of water is required. The PAX system utilizes time-proven dry ash storage and vacuum conveying to collect and transfer bottom ash in a dry state. This system also provides heat recovery and improved boiler efficiency.

Three subsystems comprise a typical PAX System:

- A dry hopper where the ash is collected, crushed and fed to the vacuum system.
- A vacuum system for dry ash removal and conveying.
- A storage bin and unloading equipment for final disposal.

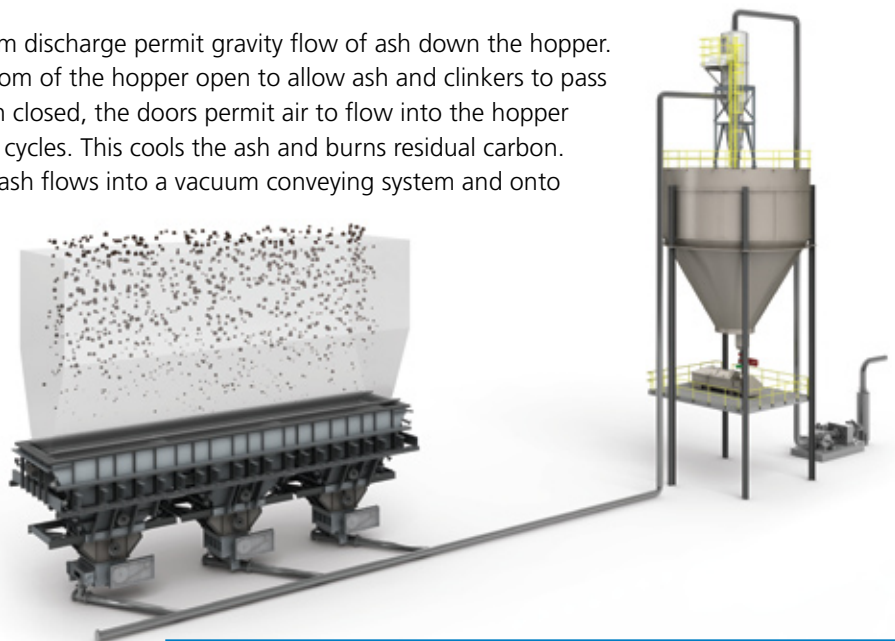
[100% DRY]

- EASILY RETROFITTED AROUND STRUCTURAL BARRIERS
- PROVIDES IMPROVED HEAT RECOVERY AND BOILER EFFICIENCY
- DOES NOT REQUIRE WATER
- ELIMINATES ASH STORAGE PONDS



System Operation

Steep walls and bottom discharge permit gravity flow of ash down the hopper. Grid doors at the bottom of the hopper open to allow ash and clinkers to pass into the crusher; when closed, the doors permit air to flow into the hopper during non-conveying cycles. This cools the ash and burns residual carbon. From the crusher, the ash flows into a vacuum conveying system and onto the storage location.



Systems

Vibratory Ash Extractor (VAX™)

Next Generation Technology for Dry Bottom Ash Handling

The Vibratory Ash Extractor (VAX) System is the latest evolution of dry bottom ash technology, transporting and cooling ash in one efficient process. It is the most reliable, heavy-duty and cost-effective dry bottom ash handling system on the market.

The VAX system features a rugged design and durable construction to handle the extreme operating conditions of coal-fired power plants. Unlike other mechanical bottom ash conveyor systems, there are no moving belts or hinged joints that can become damaged from large slag falls or foreign material such as soot blower or tube shields. The result is system reliability and reduced risk of unplanned outage.



[100% DRY]

- PROVEN TECHNOLOGY
- HIGHEST HEAT RECOVERY
- LOWER OPERATING COST
- ELIMINATES ASH STORAGE PONDS

System Operation

Designed for simplicity and safety with no internal moving parts, the VAX System requires virtually no maintenance and its overall operation is unmatched in the industry. Using proven vibratory conveying technology, ash is advanced through a series of successive throws using an oscillatory toss-and-catch motion. Controlled forced draft air enters through the vibratory conveyor deck and surrounds the entire ash surface as it is suspended between throws, creating a fluidized bed of ash. The result is increased cooling and combustion.



The UCC Commitment

As an industry innovator, we have long been at the forefront of ash handling technology. We recognize the importance of providing customers with the best equipment and latest technology that meet their demanding requirements and plant needs.

With our own advanced testing and technology lab, we are able to maintain control over the quality and delivery of our systems and equipment. The result is superior and predictable performance for our customers.

Our dedicated team of engineers, sales, service and in-house design team spans the globe covering six continents, assuring you that we can provide exceptional service whenever needed. This is our commitment to you.

UCC is your source for all of your ash and reagent handling requirements.

UCC Material Handling Solutions

Fly Ash (Dilute, Medium and Dense Phase)

- Vacuum Systems
- Pressure Systems

Bottom Ash (Wet and Dry Solutions)

- Hydraulic Systems
- Pneumatic Systems
- Mechanical Systems
- Vibratory Systems

Mill Rejects

- Hydraulic System
- Pneumatic Systems

Reagent Handling Systems

Pulverized Fuel

System Components

- Crushers
- Tanks/Vessels
- Filter/Separators
- Gates/Valves
- Mixer/Unloaders
- Pipe/Fittings

Global Operations in:
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Over 50 Offices Worldwide

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CORPORATION

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