

**Drying of Minerals and Aggregates**  
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The purpose of this White Paper is to provide an overview of the minerals drying technologies available today and the advantages and disadvantages of each.

Typically, the first step in the processing of minerals and aggregates after mining is a washing and classification process. The material may be screened and stored but at some point moisture content needs to be reduced to meet a specification required for sale or further processing. The drying of your product is commonly the greatest operating expense in your process and therefore with proper planning can be your greatest cost savings opportunity.

There are several drying technologies that are commonly used in industry today for minerals and aggregates:

- **Rotary drum dryers** are large rotating drums where the material cascades through a stream of hot air. Rotary dryers are often presented to have a "low initial cost advantage" but may require additional equipment and manpower to operate successfully. The main disadvantages are high operating costs due to higher fuel consumption, elevated maintenance costs and additional manpower to operate. Rotary dryer systems often include basic controls that require frequent monitoring by an operator to regulate for changing conditions.
- **Static fluid bed dryers** utilize large volumes of heated air to fluidize the product. In practice, these dryers have thicker product layers that require larger blowers to keep the product suspended in the air stream. This process offers improved fuel efficiency because the increased product layer retains heat and thermal heat transfer is maximized. This dryer may offer the advantages of low initial cost and simplicity of operation but product flexibility will suffer. Its main disadvantage is that the dryer is designed for and requires a consistent and uniform material size. If oversized, out-of-spec material is introduced into the dryer, it will not exit, but remain inside and will eventually prevent operation. At some point in time, the dryer will have to be shut down and cleaned out. Static fluid bed dryers are most suitable for processes that have little process variation. If the input mix/size varies, use of a static fluid bed dryer is not advisable. Static dryer systems often include basic controls that require frequent monitoring by an operator to regulate for changing conditions.
- **Vibrating fluid bed dryers** use a large drive mechanism with the bed mounted on springs like a vibrating conveyor to move product through the dryer. They have the advantage that they can process a wider range of products. The main disadvantage is that the dryer and the product are subjected to significant g-forces. These high forces typically cause friable product to break apart creating unnecessary and often unwanted fines and waste. In addition, the high g-forces will be transferred to the surrounding structures resulting in additional installation requirements, premature equipment wear, premature instrument wear and elevated noise. This causes the bed case to fracture and the drive mechanisms are subject to periodic refurbishment. Instrumentation takes a beating too, so the control systems are typically very basic. Vibratory dryer systems often include improved controls that require less monitoring by an operator to regulate for changing conditions.

- **Shaking fluid bed dryers** solve the high g-force issue by eliminating the need for vibration and include a more advanced control systems that eliminates the need for continuous operator involvement. Product is moved through the dryer by a gentle shaking motion, Low Frequency / High Amplitude, which moves it forward in a step by step uniform manner referred to as plug flow. The g-force issue is eliminated allowing for smallest possible product deterioration, reduced foundation requirements and minimal noise output. A shaking fluid bed dryer system typically has a higher initial cost but the lowest life cycle cost via substantial savings in fuel consumption and maintenance costs.

There is a surge in demand for “frac sand” in North America today, and Ventilex fluid bed dryers are ideally suited to this application. The following section uses this application as an example – the rationale is similar for other minerals and aggregates.

“Frac sand” is the common term for hard, spherical sand used a proppant in natural gas extraction. The sand, meeting strict API specs for spherical shape, hardness and size, is used to fill and make porous the cracks in the rock after hydraulic fracturing so the gas can escape from the shale and be captured. Typically, the sand is mined, washed and screened and stored in piles for supply of various grades of frac sand. The sand needs to be dried to the required moisture content before it can be sold or further processed to add a resin coating.

It is typical of rotary driers to overheat the product to insure that it meets spec. The logic is “more heat is better” and “hot sand is dry sand.” The rotary dryer may be efficient at constant input moisture content but this does not happen in the real world – the input moisture content varies all during the work day. It depends on where you take the sand from the pile. Therefore, you have to set the heat for the worst case and this commonly results in overheating. The exit temperature of sand in rotary dryers is typically over 200 F. **However, this conventional wisdom is costing you money.** The exit temperature of a Ventilex shaking fluid bed dryer is typically under 165 F. How can the sand be dry at this temperature? It is the evaporative effect. Ever notice how cool you get when you exit a pool in the desert in the daytime? The hot, dry air really cools you off. You stay cool as long as you are wet. You get hot as soon as you dry. The sand behaves exactly the same. The Ventilex control system uses a very hot stream of air to evaporate the water but discharges as soon as the water is gone. It does not waste energy heating up the sand. This extra temperature is just wasted energy and money.

The control system utilized by Ventilex has been perfected over the past 20 years in over 800 applications - over 250 in minerals and aggregates. The control system has been developed and is supplied by Trecom Industrial Automation BV, a sister company to Ventilex and also part of the Imtech group of companies. Trecom has world class expertise in industrial control and automation systems and their expertise is ideally matched to fluid bed dryer systems. The system uses predictive logic to perfectly match burner power to the moisture content of the sand – not too dry, never wet, but to spec. As a result, the energy usage is far less than any other system. **The BTU calculator tab provides an estimate of the savings over other systems.**

Ventilex has three **standard frac sand dryer systems** of 100st/hr, 150st/hr and 200st/hr input capacities. These standard systems are pre-engineered for reduced delivery time and cost. Typically, the systems are specified to reduce moisture content from 5.5% to 0.5%. Sand from storage piles is introduced into the dryer but the moisture content can vary from 8% to 4% based on weather conditions and where it is taken from the storage pile. Our Ventilex shaking fluid bed dryer with its sophisticated control system

adjusts itself perfectly to match the input moisture content and not over or under dry the sand processed.

Ventilex USA sources the dryer and the control system from its parent company in Europe. These two components are the heart of the system. This is where fine European design and craftsmanship pay off. The other components of the system: the burner, the bag house, the duct work and the blowers, are specified by Ventilex and supplied via high quality domestic suppliers. The benefit to our clients is lower cost and ease of repair and maintenance – these components come from local sources you likely already use elsewhere in your plants. However, the entire dryer system will be supplied by Ventilex meaning you are guaranteed the components match and that the system will perform to specifications. Think of the dryer system as a “Black Box.” Your plant feeds the “Black Box” wet sand and gets dry sand out at the lowest total cost. Energy usage to perform this task is guaranteed by Ventilex.

Some of our competitors will happily sell you a dryer and leave the controls and other system components up to you. It is a quick and easy sale to them but this transfers all the process risk to you. They will not guarantee energy usage – you are on your own. What do you need – a collection of expensive components or dry sand at lowest total cost?

You will live with your drying system for years and pay the price of excessive energy cost year after year if you take the low initial cost solution. If you really need a “quick and inexpensive entry point” to dry sand, you may be much better off installing a used rotary dryer as a short term interim solution followed up with a Ventilex shaking fluid bed dryer to save energy costs and reduce downtime.

**In summary, Ventilex shaking fluid bed dryers have three main advantages:**

### **Guaranteed Energy Savings**

When drying large volumes of material, energy consumption is your greatest controllable expense. Ventilex fluid bed dryers maximize return on investment by reducing energy expenses.

It may be hard to believe, but the energy cost per year to operate a large dryer is typically as much as the initial investment in the dryer. Ventilex dryers are engineered and manufactured in Europe where energy costs have been up to three times higher than in North America.

We pioneered state-of-the-art designs to recapture the thermal energy that was once just exhausted to the atmosphere. Combining our energy efficient design with PLC controls and the most advanced algorithms in the drying industry allows us to GUARANTEE you energy savings of 10 to 60 % over any other dryer manufacturer.

We are the only supplier that will provide a WRITTEN GUARANTEE of your energy consumption. There is no fine print, we make it work.

With our dryers, the more you dry, the more you save on energy.

### **Maximum Yield**

Fines created in the drying process represent a significant loss of revenue for many material producers. Ventilex fluid bed dryers offer “low impact” processing of your material, taking advantage of a lower frequency shaking action that reduces waste.

Our fluid bed dryers, engineered and manufactured by European craftsman, use a gentle shaking motion that never generates more than 1g of force, compared to vibrating fluid bed mechanisms that generate as much as 8g. This gentler approach to drying your product creates substantially less fines.

Fewer fines = less waste = more revenue.

Combine our state-of-the-art sensors, PLC controls, the most sophisticated drying algorithms in the world with our unique approach to fluidization and you get the best return on investment of any dryer technology for high-value product drying.

### **Highest Uptime**

When uptime matters, Ventilex fluid bed dryers and coolers deliver the highest availability in fluid bed dryer technology. Ventilex offers a very fundamental advantage in non-static fluid bed dryers: fewer and less expensive moving parts operating at a much lower frequency.

Think about it; a mechanism operating at lower frequency, with fewer moving parts.

When properly maintained, Ventilex systems regularly exceed 98% percent uptime. When maintenance is required, the parts are less expensive compared to a vibrating fluid bed. Fewer repairs, shorter time to repair.

When uptime is critical, and downtime is lost revenue, Ventilex dryers deliver the best return on investment.