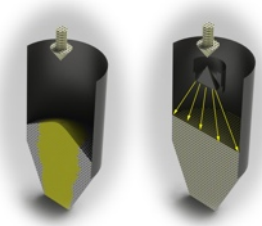
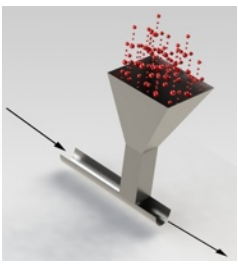
JENIKE & JOHANSON
Bulk Solids: Science/Engineering/Design

# Flow of Solids

Newsletter Q1/2012





# Cost Effective Silo Design for PTA

### Background

Having just received a custom equipment design from Jenike & Johanson to solve all your handling problems, you request competitive bids for fabrication of the design.

When evaluating any equipment bid, consider how well each bidder understands the requirements of the job. Not knowing the design intent and requirements for providing reliable material flow typically results in an underbid for the equipment. Sometimes the result is an extremely high bid.

### The Problem

A client of Jenike & Johanson was expanding storage and handling capabilities for purified terephthalic acid (PTA). As part of the expansion, an existing silo would be retrofitted with a new mass flow transition hopper. The basis for the design of the new hopper was a similar hopper, designed and supplied by us that was handling the same material. This hopper had been performing as intended since it was installed more than 20 years ago.

The design was sent out for bids. Since its top diameter was only 10 ft, the unit could be shop fabricated. Several pieces of existing equipment would have to be temporarily removed so that the new hopper could be installed. The estimated cost for relocating this equipment was significantly more than the cost of the hopper itself.

Our client contacted us again for assurance that the new hopper design would work as intended, handling the material at a higher discharge rate than the previous solution.

### The Solution

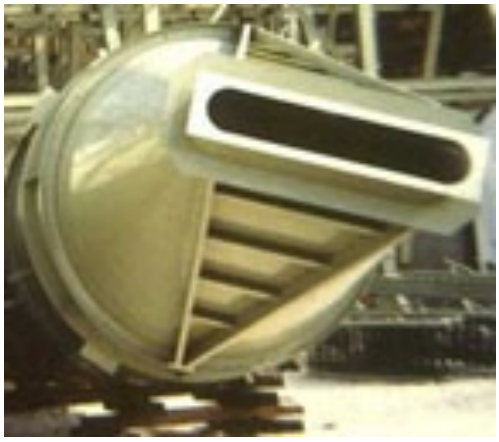
After our site visit, we recommended small but critical changes to the original hopper to ensure that the higher discharge rate could be achieved. These recommendations were based on recent flow properties tests performed to ensure that the material's handling characteristics had not significantly changed over the last 20 years since it was first tested.

We then designed the new transition hopper in sections that could be bolted together. This allowed installation with minimal equipment relocation costs while still ensuring reliable flow. Although the redesigned hopper was more expensive, the total installed cost was reduced by about 50%, since less equipment had to be temporarily removed for the installation.

A very tight schedule was required by the client. Because Jenike & Johanson was able to work on the design and fabrication simultaneously, the contract was awarded and the project was delivered on time.

### The Result

The new hopper has been in operation for several years. Our client describes it as one of the most reliable parts of the operation.



# CEO's Message

These are exciting times at Jenike & Johanson. We have just opened our fifth office -- this one in Perth, Australia, with full testing and engineering capabilities. Our aim is to be close to our clients in the planning stages of new projects, help them avoid costly bulk solids storage, handling, and processing problems sooner rather than later. Being close to our clients also allows us to mobilize quickly to investigate existing problems and develop reliable, cost effective solutions.

We take pride in generating options for our clients to reduce cost without sacrificing operational efficiency. Our case study of the PTA hopper design in this issue is just such an example. In that project, not only did we produce a cost-effective option for retrofitting the hopper, we also provided detailed design of the new hopper and fabricated it, ensuring that our recommendations were fully and correctly implemented within a very tight time schedule.

It might be a worn out cliché to say that our mission at Jenike & Johanson is to make the world a better place, but indeed that is ultimately how we see ourselves. Whether it's reducing waste at a food processing plant or a pharmaceutical operation, helping develop renewable energy from biofuels, controlling dust generation at a load-out terminal, or minimizing the use of purge gas in a resin processing plant thereby reducing total energy consumption, we are helping the world become a better place one client at a time. No matter whether you are an existing client or one we have yet to work with, we look forward to working with you on your next project. Please contact any one of our *five* offices to discuss your application with one of our engineers at no obligation to you.

*Herman Purutyan, CEO*
*Jenike & Johanson, Inc.*

# Excitement in Australia


To support the rapid growth of our clients in Australia, we are proud to announce the opening of Jenike & Johanson Pty Ltd in Perth, Western Australia. Our Perth facility includes both a flow properties testing lab and an engineering office. Services we offer through our Perth office includes:

- on-site evaluations
- material properties testing
- problem solving, conceptual designs
- process development
- models
- simulations
- functional designs
- detailed and structural designs
- procurement assistance

Jenike & Johanson is grateful to have such strong client demand in Australia and are committed to helping our clients realize long-term growth and significant gains from their operations by improving client access to state of the art technology in bulk solids processing.

# Behind the Scenes: Meet Corin Holmes

CORIN HOLMES is our Technical Officer in Perth. For the past ten years Corin has been at our Toronto office, as a Bulk Solids Technologist. His interest in the field of Bulk Solids Handling led him to obtain his Masters of Engineering in Bulk Solids Handling, from the University of Greenwich, UK. He has worked on a variety of projects, from 10 ton bins to 50,000 ton stockpiles, mainly in the mining industry, helping to ensure reliable flow.

Corin states, "One of the best parts of this job is being able improve or create a design validated through flow property tests and physical models. My reward comes with the knowledge that my efforts and experience have helped to prevent or solve very real problems."

# Behind the Scenes: Meet Carrie Hartford

CARRIE HARTFORD is our Senior Engineer in Perth. Carrie received her Bachelor's degree in Physics Engineering from Westmont College in Montecito, California and her Bachelor of Science degree in Mechanical Engineering from the University of California, Santa Barbara. Subsequently, she received her Masters of Business Administration from Azusa Pacific University in Azusa, California. As a Senior Engineer in our California office, she has been involved in troubleshooting and recommending corrective actions for solids flow problems, providing recommendations to avoid solids flow-related problems in new installations, and the design and supply of customized handling and test equipment related to this field.

Examples of some designs include a 500 ton potash surge bin and apron feeder, a 20,000 ton clinker silo, a copper ore comminution cycle, live capacity calculations for bauxite, gold ore and saprolite ore stockpiles, and load calculations for large silos. She has lectured on the storage and flow of bulk solids for the American Society of Mechanical Engineers (ASME), the American Institute of Chemical Engineers (AIChE), individual companies, in-house courses, and conferences. Carrie states, "What makes my job rewarding is developing a scientifically-based design to help clients overcome problems that have caused them headaches for years. It is also great to get involved early on in a project in order to prevent those problems all together."

# Jenike & Johanson Distributor Increases Bin Capacity

Over the years, Jenike & Johanson engineers have developed and improved a simple rotating distributor which can increase a bin or reactor vessel's capacity up to 20 percent over that which is possible with central filling.

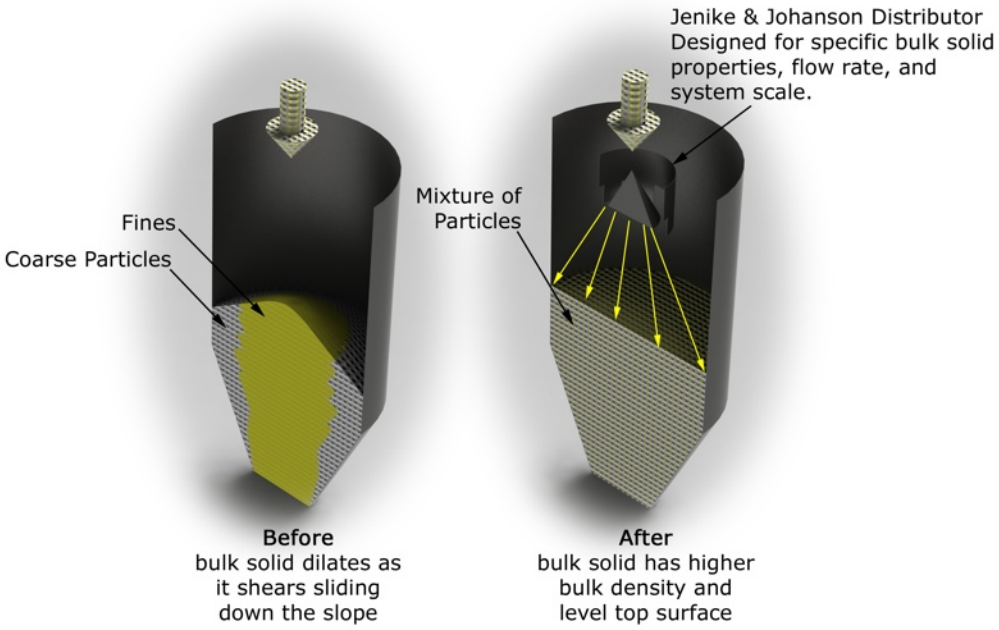
When filling a bin from a central charge point, material forms a sloping conical pile. Material added to the bin slides down the slope of the pile at its angle of repose and undergoes significant shear strain at low consolidating stresses. Most bulk materials dilate when sheared in this manner, resulting in a low bulk density. This is particularly true for materials with thin, flat particles such as wood chips and flaked products.

Central filling can also result in size segregation with nonuniformly sized particles. The fines become concentrated in the center and coarse at the periphery of the bin. (Learn more about segregation).

The Jenike & Johanson distributor spreads material out uniformly over the entire top of the pile, thus forming a level surface. This is in contrast to most mechanical spreaders which simply fling material to the periphery of a bin, causing a downward slope towards the center. With this distributor, material no longer slides down a pile, the shearing action is eliminated, and a much higher bulk density is achieved. In effect, particles are dropped individually onto a level surface. Flakes deposited in this manner lay horizontally and, if undisturbed, achieve a dense packing. In one instance with wood chips, Jenike & Johanson technicians measured a 22 percent increase in bulk density using this distributor.

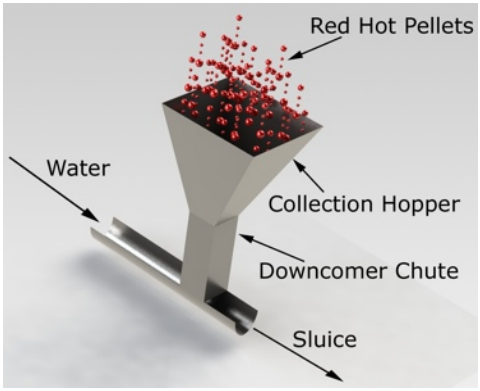
A wide range of bulk materials can be handled with this distributor, segregation by the sifting mechanism is significantly reduced, and level control is more reliable because the top surface is level.

For more information, call your nearest office of Jenike & Johanson.




# Jenike & Johanson's Expertise Helps to Settle Lawsuit Quickly

How do you convince a jury that a change in the design of a chute and water sluice at a pellet plant led to a steam explosion which killed two workers and severely burned a third? This problem confronted one of Jenike & Johanson's engineers as he prepared to act as an expert witness in a law suit brought against the designers of the plant. It would be impossible to use a purely analytical approach or set up a full-size model in the courtroom. Even a scale model would be very messy and might raise more questions than it would answer. The solution: construct a full-scale, cold model in our San Luis Obispo, CA laboratory and videotape the results.




**System at plant**

The equipment in question consisted of a pyramidal collection hopper and downcomer chute below which was a sluice (i.e., sloping trough filled with running water). In the plant, red hot pellets were collected in the hopper, directed into the chute and then conveyed via the sluice to a reprocessing area.

**Model tests**

In the demonstration we used various sizes and shapes of pellets, sluice arrangement (1) as originally designed and (2) after modification by the plant. The differences between the designs were dramatic. In the original sluice design, water quickly and reliably conveyed the pellets away from the impact point as soon as they dropped from the chute into the sluice. In contrast, the modified design was far less efficient and blocked several times during the test. Such a blockage at the plant would have caused the chute and upstream hopper to fill up which was in fact what happened the day of the accident. When the workmen tried to clear the hot pellet blockage using fire hoses, a steam explosion occurred. All three workmen were severely burned and two eventually died.

When the opposing attorneys saw the model test results on videotape, settlement discussions quickly ensued. The case was settled out-of-court, thereby saving our client a considerable amount compared to the figure originally requested by the plaintiffs.

**Laboratory capabilities**

Our San Luis Obispo laboratory has extensive model-making capabilities. It includes a fully-equipped machine shop, an overhead crane and experienced personnel highly skilled at fabricating unusual systems. Moreover, videotaping the model allows a jury or more often plant and process engineers to understand a specific aspect of bulk solids flow.

# Latest Publications

**How to Reliably Feed Material into your Pneumatic Conveying System**
Jayant Khambekar &
Eric Maynard
July 2011

**A View of South American Bulk Solid Technology**
Alfredo del Campo
May 2011

**Achieving Reliable Material Flow in Coal Preparation Plants**
Jayant Khambekar, Roger Barnum & Roderick Hossfeld
August 2011

**Development of a Material-Sparing Fluidization Characteristics Method**
By Thomas Baxter, James Prescott & K. Eric Bengtson
October 2011

**Designing Dust Collectors**
Greg Mehos
September 2011

**Process Design Considerations For Degassing Polymer Powders**
Brian Pittenger
September 2011

**What Material Characteristics Should I Consider When Selecting a Storage Vessel?**
Jayant Khambekar, David Wheat, Dave Hesketh & Larry Guenther
November 2011

**Biomass Co-firing: Challenges Involved in Material Handling**
Jayant Khambekar
November 2011

**Flyash Handling: Challenges and Solutions**
Jayant Khambekar &
Roger Barnum
December 2011

# Upcoming Events

**March 13 -15 Ahmedabad, India**
Bulk Solids India
J&J will present: How to Prevent Particle Segregation and Improve Product Quality

**March 13 - 14 Atlanta, Georgia**
PBE's 2012 Southeast Conference
J&J will present: Troubleshooting Pneumatic Conveying Problems, Preventing Caking & Attrition

**March 20 - 21 Las Vegas, Nevada**
J&J will present ASME/AIChE courses *:
Flow of Solids in Bins, Hoppers & Feeders & Pneumatic Conveying of Bulk Solids

**April 2 Orlando, Florida**
NPE 2012 ANTEC
J&J will present: Troubleshooting Plastics Industry Powder Storage & Handling Problems Using Flow Properties

**May 8 - 10 Rosemont, Illinois**
PTXi 2012
J&J will present: Powder Flow Fundamentals, Silo Design, Blending/Sampling/Segregation

**June 4 - 6 Houston, Texas**
J&J will present ASME/AIChE courses *:
Flow of Solids in Bins, Hoppers & Feeders & Pneumatic Conveying of Bulk Solids

* For more information, please visit **www.aiche.org**

# Please join us on our new social media platforms

Jenike & Johanson is pleased to announce three new communication platforms on the Internet.

First, feel free to join our LinkedIn network by searching for "Jenike & Johanson, Inc." Next, you can now follow us on Twitter @JenikeNJohanson. Our LinkedIn and Twitter accounts are a great way to keep up to date on the latest events, courses, and general news occurring at Jenike. We will also send updates via these tools when we have new videos available on our own YouTube channel at **www.youtube.com/user/JenikeJohanson.** Our new YouTube channel will host special messages from our team as well as brief technical presentations highlighting key components of courses. Currently we have a video message from our CEO, Herman Purutyan.

**We look forward to you joining us!**

# For more information

On publications, please send an email to **mail12@jenike.com**

# News

Follow Jenike & Johanson's latest news items on Twitter at **www.twitter.com/JenikeNJohanson**

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