



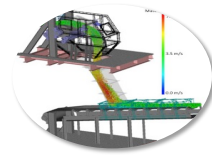
## How Jenike & Johanson Can Help You with Reducing VOCs, Recycling and Sustainability

Dr. Jayant Khambekar  
Senior Consultant

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### About Jenike & Johanson

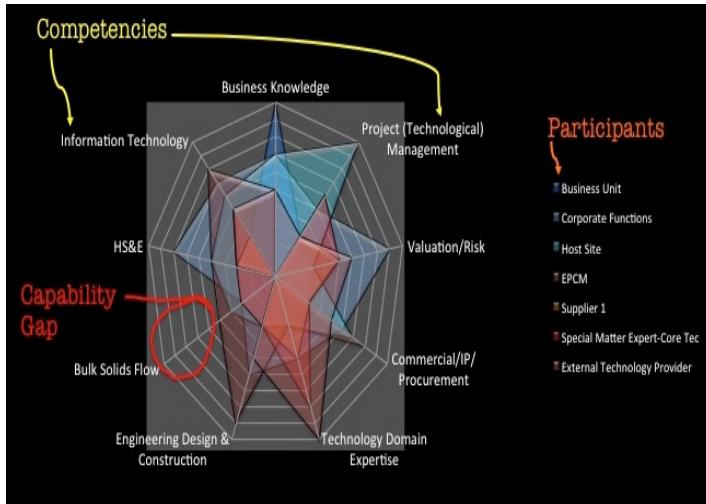
- Advanced technology firm
- Technology to achieve reliable flow and handling of all kinds of powders/bulk solids
- We have been in business for more than 50 years
  - Founded by Dr. Andrew Jenike in 1966
- Growth in 50+ years:
  - 3,000+ clients worldwide
  - Offices in five countries: USA, Canada, Chile, Brazil and Australia
  - Three offices in the US: Tyngsboro (MA), San Luis Obispo (CA), and Houston (TX)
- Work on projects that involve new handling system design as well as retrofits



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# Study Conducted on Why Projects Fail



Twigge-Molecey, C. "Knowledge, Technology and Profit" 2003 - Cobre 2003; Fifth International Conference; Santiago; Chile; 30 Nov.-3 Dec. 2003. pp. 41-57. 2004

Wellwood, Grant. "Fail to plan? Plan to fail!-The case for Capability Mapping", LinkedIn Post March 2016.



Solids flow expertise is crucial to success

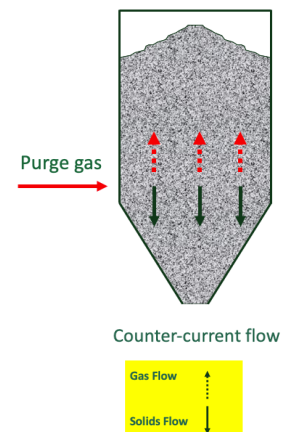
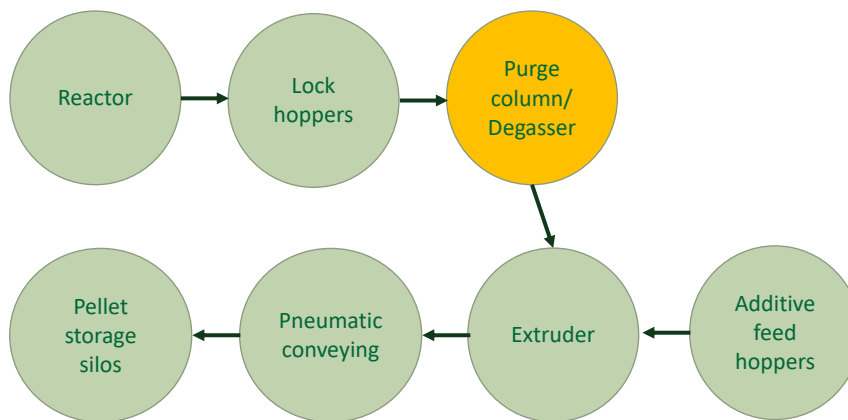
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# Importance of Solids Flow in Reducing VOCs

## Process flow for polymer production



Issues with solids flow  
Issues with gas distribution

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## Solution: J-Purge™ for Gas Injection/Distribution

### ► Features:

- Achieves uniform solids flow
- Achieves uniform gas introduction

### ► Benefits:

- Reduces purge gas usage
- Minimizes grade change-over time
- Allows increased throughput rate from purge column
- Lowers residual monomer concentrations

### ► Based on:

- “Mass-flow” technology
- Proprietary two-phase gas/solids interaction models

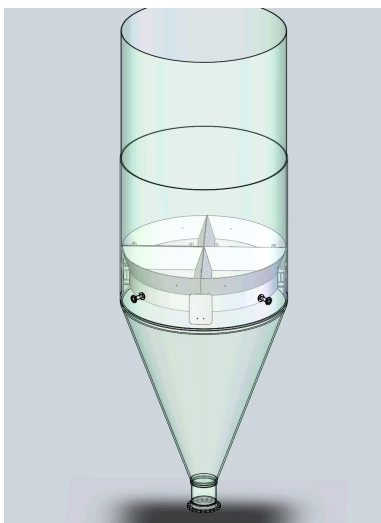


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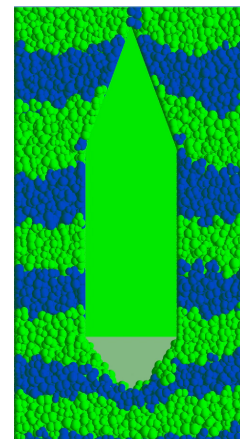
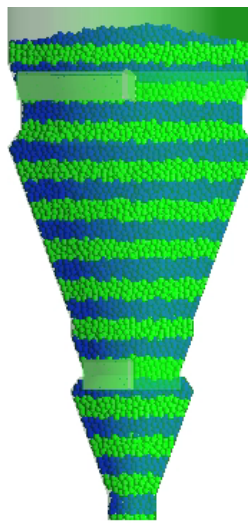


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## Achieving Mass Flow in Purge Columns/Degassers



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Velocity gradients !

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# Modeling Particle Displacements in Mass Flow

Advancements in granular mechanics



New technology developments

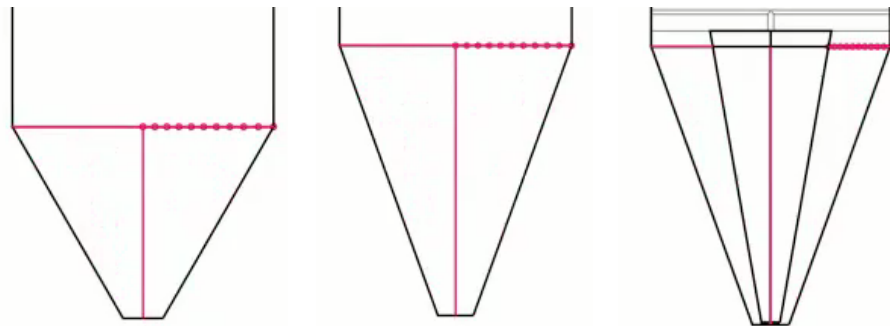
- Physical trials
- Column performance checks
- Verified solids flow models:
  - (a) DEM
  - (b) Computational

## Classical modeling



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## Computational modeling



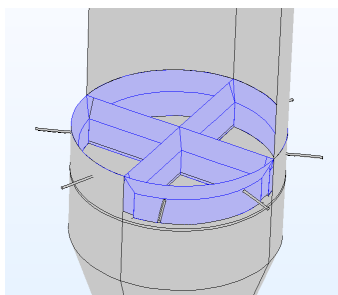
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# Modeling Gas Flow in Purge Columns/Degassers

Technology to study interaction between gases and powders: to understand net effect on gas flow.

Predict: (a) Distribution of gas, (b) Velocity field

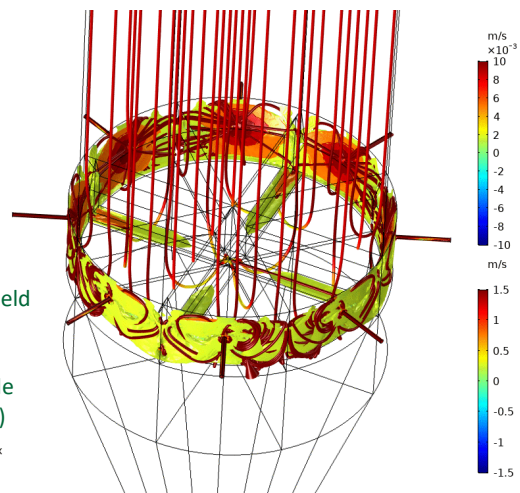


J-Purge™ with 4-Xbeams  
and 8 injection nozzles

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Streamlines: gas velocity field  
in bed (top legend)

Surface: velocity magnitude  
in plenum (bottom legend)

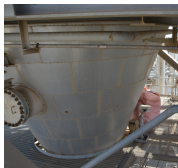


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## Complete Solutions



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## Sustainability and Recycling Feedstock



### Mechanical recycling

First separation:

- Polyethylene
- Polypropylene
- HDPE
- PET

Handling shredded feedstock - concerns:

- Erratic flow
- Flow stoppages

Blending recycled resin - concerns:

- Uniformity/variations
- Quality issues



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## Solving Quality Issues – A Case Study

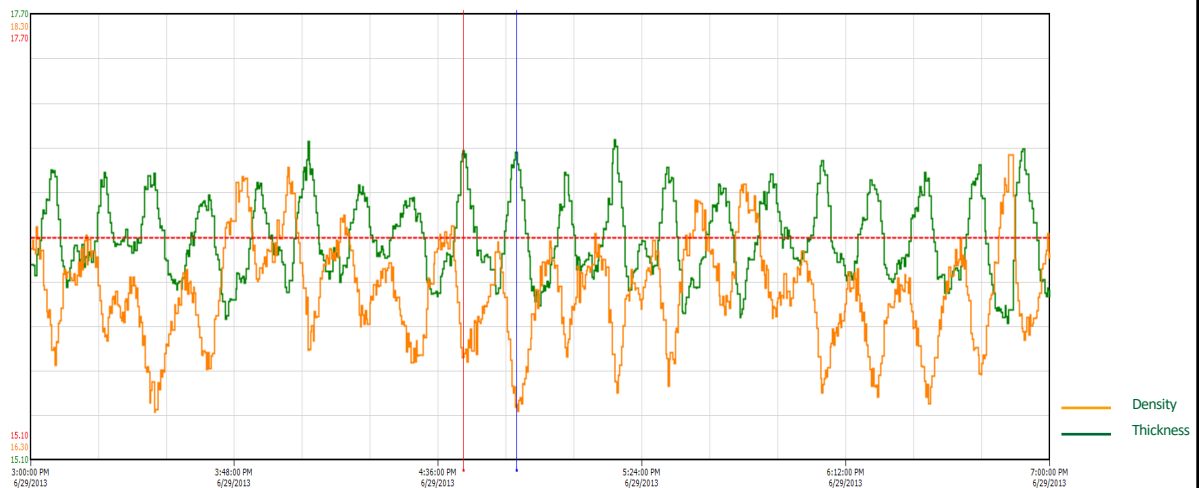
- Batch-blending: recycled PE + virgin PE  
Transferred to surge bin  
Fed to continuous extrusion process
- Result: unacceptable product variation,  
diminished performance
- Business reaching a point of questioning  
whether using recycled resin made sense ...



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## Findings from the Site Visit and Data Analysis



The period of the cyclic variation related to blending batch size.



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## Analysis of Equipment with Test Data

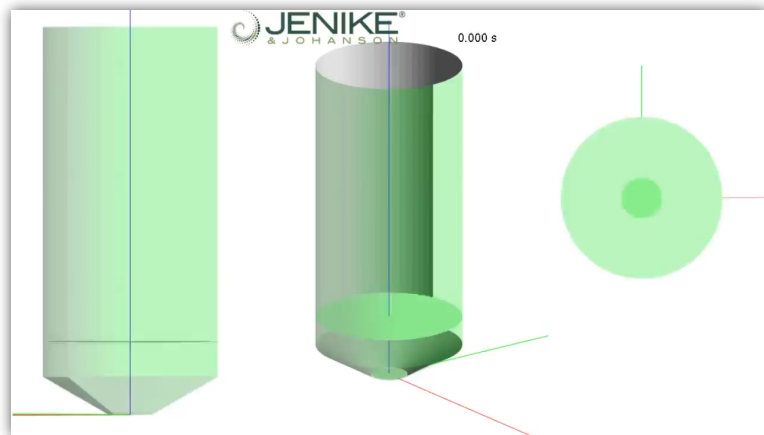


Surge bin discharged in "Funnel Flow"



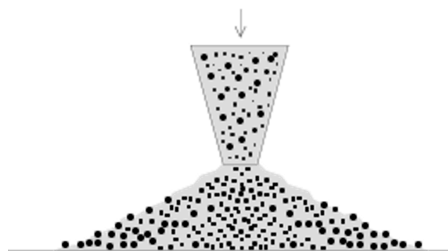
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Using test data, built DEM model



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## Analysis of Segregation of Blend During Handling



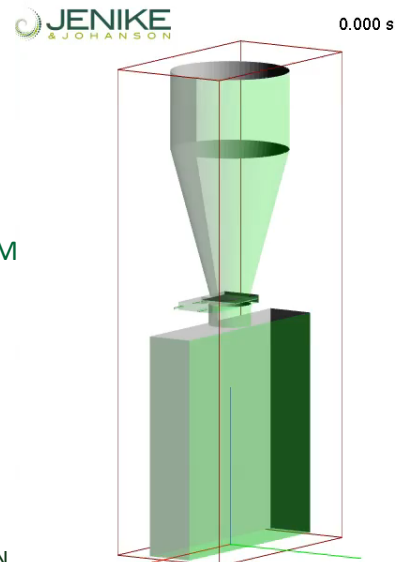
Particles segregate by size difference

Combination of segregation and funnel flow led to quality issues.  
Based on test data, equipment were modified to achieve mass flow.



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Applied DEM



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## Conclusions

- Latest technology is available for uniform gas injection in purge columns/degassers to further lower VOCs.
- If solids flow vessel designs focus on low-cost, and ease of fabrication, risk of poor process performance increases.
- Vessel designs must be based on solids flow behavior and test data to achieve good performance.



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## Thank You !

## Questions ?

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- Call: 281-921-1998
- Visit: [www.jenike.com](http://www.jenike.com)



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