



Research Project Brief

Predicting Powder Flow from Containers with Flexible Walls

The International Fine Particle Research Institute (IFPRI) wishes to fund a research project to develop predictive models for flow of dry powders from bulk containers with flexible walls. Design and analysis methods are well established for bins and hoppers with rigid walls, however these have never been extended to situations where the wall is flexible, such as flexible intermediate bulk containers (FIBCs). Users of these containers have no a priori way of determining how their materials will flow from these containers, and manufacturers have no way to design their flexible bins to guarantee efficient discharge.

The primary objective of this project is to develop a design and analysis model analogous to that used for rigid-wall bins and hoppers that is appropriate for FIBCs and similar containers. This model should, at a minimum, predict the boundary between bridging and flow as a function of bulk powder properties, wall mechanical properties, and container geometry. It should also predict flow regimes, e.g., boundaries between no flow, funnel flow, and mass flow. The project should explore how changes in FIBC geometry due to bulging and stretching during filling and storage impact discharge and investigate the efficacy of internals that are included to minimize bulging. A stretch objective of the project is to develop a predictive model or correlation for the discharge flow rate.

Mechanical flow promoters are often used to facilitate flow from FIBCs. These include massagers, extenders and rams. Proper selection and use of these devices can improve flow; however, they frequently do the reverse. A second objective of this project is to develop a validated regime map or physically based guidance for selection and use of these devices.

The scope of this project includes non-cohesive to cohesive (including moist, but not saturated) powders with a range of mean particle size of 15 microns to 5 mm and bulk containers from 0.5 to 3 m in height constructive of materials commonly used in FIBCs. Use of flow aids to promote discharge is out of scope.