

Kansas State Bulk Solids Innovation Center



Bulk Solids Innovation Center

Facility Information

Research Capabilities

Professional Development

What are bulk solids?

Testing Fees

Partners and Donors

News

Center Location

K-State Bulk Solids Innovation Center

607 N Front St.
Salina, KS 67401

Contact:

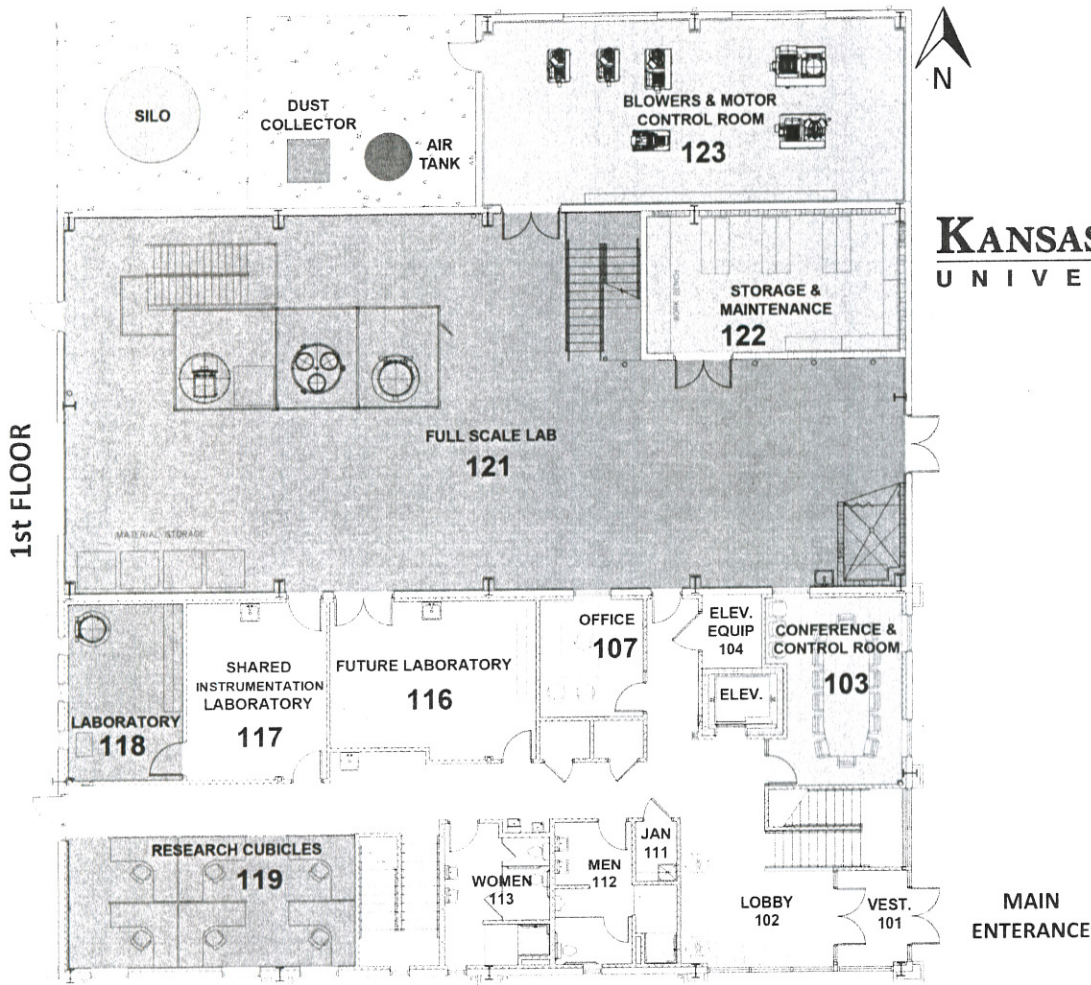
Johnselvakumar Lawrence, PhD
Research Director
Kansas State University
Polytechnic
jlawren@k-state.edu

Research Capabilities

Kansas State University Bulk Solids Innovation Center is used to study and develop the understanding of bulk solids materials handling, in turn enhancing the businesses that use these materials or manufacture the systems that convey, store and dispense them. This university-level research center is the only one of its kind in North America.

- Research Areas – six laboratories for university and industry sponsored research
- Training/education, conference, and lecture rooms
- Material Properties Test Lab – bulk solids and particle properties can be evaluated and modeled in a test bench environment. includes a full range of lab instruments
- Full Scale Bulk Solids Test Bay – full scale systems include: vacuum and pressure dilute phase, vacuum sequencing, vacuum and pressure vessel dense phase, rotary valve dense phase, batch weighing, silo
- Zone blender, gravity flow, air filtration, feeding, mixing and silo storage

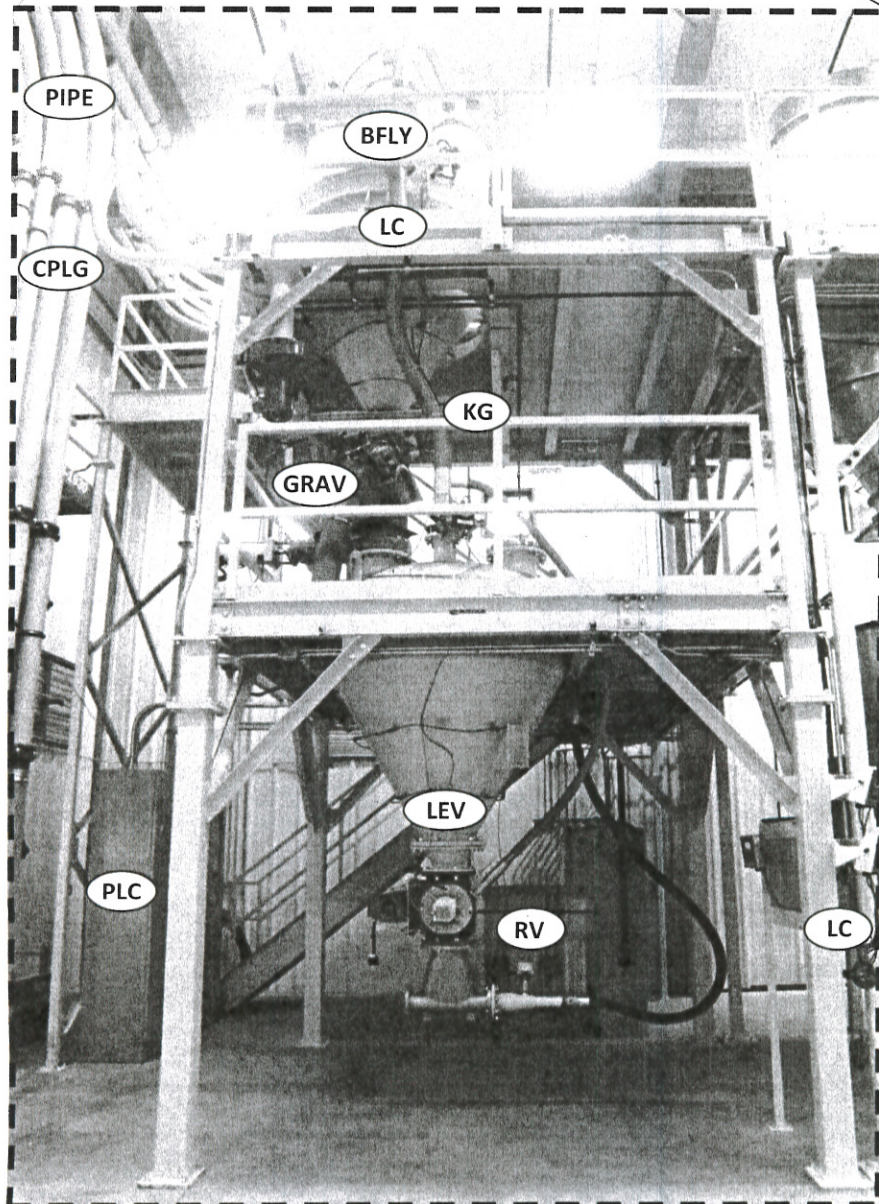
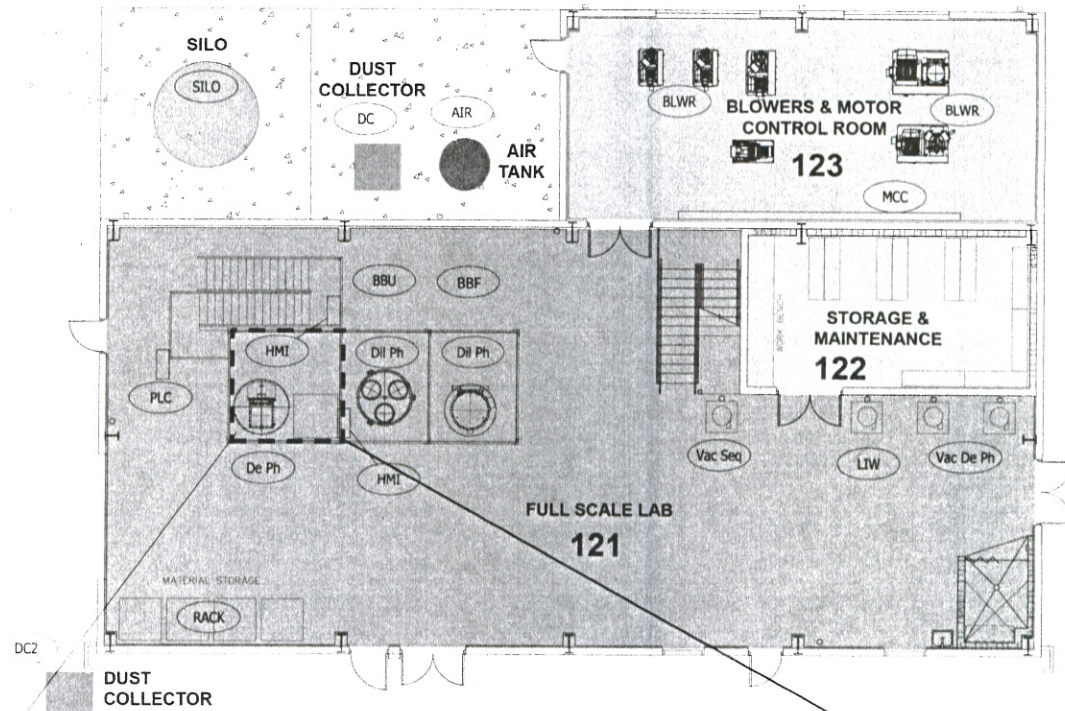
WALKING TOUR GUIDE



KANSAS STATE UNIVERSITY Bulk Solids Innovation Center

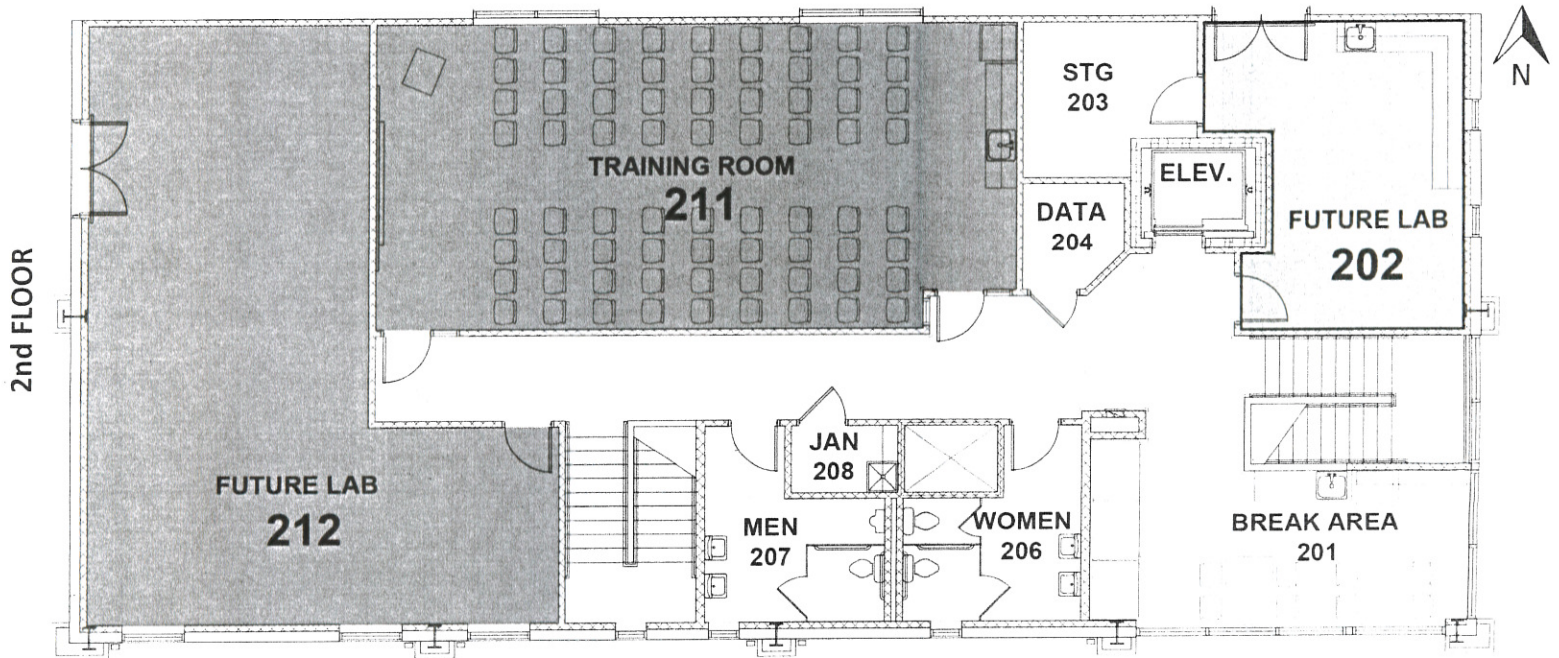


Room #	Description	Supplier	Purpose
103	Conference Room / Control Room Control Hardware Control Room Concept & Programming	Rockwell Automation Coperion K-Tron	Factory Automation Control Room can be used to monitor and control the Full Scale systems from a remote location. Also serves as a conference room with a screen for presentations Controls and computer server for automation monitoring, data acquisition, instrument communications, and server Design and programming of the controls automation, monitoring, data acquisition, and communications concept
107	Lab Manager's Office		
116	Future Laboratory for KSU and its Research Sponsors		Possible uses include measurement of material properties; new tests and computer modeling to predict actual behavior; improving flow properties of a company's particular material; system design recommendations; improving blending performance; reducing degradation; improving air usage control; reducing energy costs to convey material; making gravity flow more reliable; designing equipment to match a material's requirements
117	Shared Instrumentation Lab Powder Flow Tester Particle Size Analyzer Powder Characteristics Tester	Brookfield Engineering Laboratories Inc. Hosokawa Micron Powder Systems Hosokawa Micron Powder Systems	Includes apparatus and instruments for industry standard tests such as bulk density measurement, particle size distribution, and flow property analysis The PFT measures powder properties, including Flowability, Wall Friction, Bulk Density, Time Consolidated Flow Function Mikro Air Jet Sieve measures particle size and size distribution ranging from 20 to 4,750 microns. The PT-X measures powder properties, including angle of repose, cohesion, compressibility, aerated and packed density, uniformity, dispersibility
118	Coperion K-Tron Lab		Instrumentation and bench scale tests for measuring and predicting material properties
119	Researcher Office / Cubicles		
121	FULL SCALE LABORATORY		Equipment and Controls for measurement of actual bulk solids behaviors including storage, conveying, gravity flow, blending, segregation, degradation, dust collection, safety, and air pollution control
122	STORAGE AND MAINTENANCE ROOM		Storage of parts, tool room, maintenance
123	BLOWER AND MOTOR CONTROL ROOM		This room holds equipment that can be loud or hot, and motor controls



INSTALLATION

Supplier	Purpose
CST Industries	Silo Installation and Foundation
Airlanco	Installation of Dust Collector and Ducting
Ferco Rental	Crane, Operators, and Rigging for erection of Silo
Stanion Wholesale Electric Co.	Wire, Conduit, Racks, Electrical Supplies
Construction Rental	Rental of Lifts and Fork Trucks
Barr-Thorp Electric / Turck	Wire and Cable Connectors
Marmon / Keystone	Compressed Air Piping
Bobcat of Salina	Bobcat rental
Hawk Installation & Coperion K-Tron	Mechanical and Electrical Installation for everything except silo and dust collector
Rockwell Automation & Turck	Ethernet Communication Blocks—Instead of individual wires running from each device to the control PLC, an Ethernet loop is used to communicate all signals, so only one 24VDC power cable and one Ethernet cable is required. Future expansion will be easy since new devices can be plugged into the existing loop.
SMC	Filter Regulators- Provides clean and pressure regulated air to equipment.
Festo Corporation	Pneumatic automation controls, Air prep, and Proportional valves for control of air flow
Endress + Hauser	Signal Transmitters - Instruments sense Pressure and Flow Velocity data, and send that information to the control system



Room #	Description	Purpose
202	Future Laboratory for KSU and its Research Sponsors	Possible uses include measurement of material properties; new tests and computer modeling to predict actual behavior; improving flow properties of a company's particular material; system design recommendations; improving blending performance; reducing degradation; improving air usage control; reducing energy costs to convey material; making gravity flow more reliable; designing equipment to match a material's requirements
211	Training Room	Classroom setting for up to 56 students sitting at tables. Configurable layout to accommodate the type and size of training session. At the KSU-BSIC, students can receive lectures and presentations in the classroom, then step into the Laboratories to engage the real-life materials and equipment
212	Future Laboratory and / or Office Area	same as 202

Future Wish List: The KSU-BSIC is looking for a donor to help obtain an Environmental Chamber. Many bulk solid materials behave differently depending on the conditions. For example, handling flour or powdered sugar on the Gulf Coast during summer is different than in Minnesota during the winter. An Environmental Chamber would allow researchers to study flow properties in different conditions.

SEE FLOOR PLAN

SEE PHOTO

Room #	Description	Supplier	Purpose
121	FULL SCALE LABORATORY		Equipment and Controls for measurement of actual bulk solids behaviors including storage, conveying, gravity flow, blending, segregation, degradation, dust collection, safety, and air pollution control
BBU	Bulk Bag Unloader	Spiroflow	Holds a 2,000 lb. bulk bag of product and discharges it into the process
BBU	Hoist	Kenrich/Harrington	Lifts the bulk bag onto the Bulk Bag Unloader
BBF	Bulk Material filling system for bulk bags and other containers	National Bulk Equipment, Inc.	Ensures reliable, repeatable, highly accurate bulk bag and bulk container filling and weighing; reduces dusting and material loss; provides optimal line speed; improves safety of personnel and product.
PLC	Programmable Logic Controller	Rockwell Automation	This is the "brain" of the control system. All devices, motors, and instruments are connected to it. It reads the status of each input and sends an output signal to control each device in the Full Scale Lab.
PLC	Control Panels and Programming	Coperion K-Tron	Design and programming of the control system. Design and assembly of the control panels.
DePh	Dense Phase Conveying	Coperion K-Tron	Provides slow motion conveying to prevent damage to fragile products, or reduce wear with abrasive materials. Includes continuous conveying with rotary valve or batch conveying with a pressure vessel.
DilPh	Dilute Phase Conveying	Coperion K-Tron	Provides industry-proven higher velocity pneumatic conveying, using either pressure or vacuum
HMI	Human / Machine Interface	Rockwell Automation	Touch-screen operator control screen. This is where the operator reads information, starts, stops, and controls all of the systems in the Full Scale Laboratory.
HMI	HMI Programming	Coperion K-Tron	Programming of all the controls automation. Design and assembly of the electrical enclosure panels.
Vac Seq	Vacuum Sequence Conveying	Coperion K-Tron	Provides inexpensive conveying for small and medium rates up to 15,000 lbs (7.5 T) per hour.
Vac DePh	Vacuum Dense Phase Conveying	Coperion K-Tron	Provides slow motion conveying under negative pressure
LIW	Loss-In-Weight Feeders	Coperion K-Tron	Provides precise weighing and feed control of ingredients into processes
	Steel Structures / Mezzanine Supports/ Stairs	Hawk Installation & Coperion K-Tron	
RACK	Pallet Rack	Fastenal	Pallet rack to hold pallets of test material
PIPE	Piping Systems	Coperion K-Tron & Morris Coupling	3, 4, and 6 inch pipe systems, with configurable distances up to 920 ft horizontal length and 65 ft vertical height. Custom sizes and lengths upon request.
BFLY	Butterfly Valves	White Equipment Controls	Uses a rotating disc to open or close the valve, which allows or prevents flow through the valve
LC	Load Cells & Weighing Instruments	Rice Lake Weighing Systems	Hoppers and vessels are mounted on Load Cells, which send an electronic signal indicating the weight of material in the vessel. A floor scale is used to weigh moveable containers
CPLG	Pipe Couplings	Gruvlok	High pressure, re-usable pipe couplings
KG	Knife Gate Valves	Vortex Valves	Uses a sliding knife plate to open or close the valve, which allows or prevents flow through the valve
GRAV	Diverter Valves for Gravity Flow	Vortex Valves	Uses a pivoting blade to direct flow to one leg or the other
LEV	Level Controls	BinMaster	Detects high or low level of material in a hopper or silo
RV	Aerolock Rotary Valves	Coperion K-Tron	Feeds material into the process or conveying system
RV	Motors	Barr-Thorp Electric / Toshiba	Industrial grade, High-Efficiency Motors, Inverter Duty
DV	Diverter Valves for Conveying	Vortex Valves	Uses a slide gate with an orifice to direct flow to one pipe direction or the other
WZK	Diverter Valves for Conveying	Coperion K-Tron	Uses a rotating tunnel to direct flow to one pipe direction or the other
122	STORAGE AND MAINTENANCE ROOM		Storage of parts, tool room, maintenance
	Mobile Tool carts, Storage Shelving, Personnel Lockers	Fastenal	Tool carts provide mobile work stations for researcher laptops and bring tools to the point of use. Many components are required for interchanging equipment from test to test. These items need stored and cataloged for quick turn around. Lockers provide an area for researchers to keep personal items.
123	BLOWER AND MOTOR CONTROL ROOM		This room holds equipment that can be loud or hot, and motor controls
BLWR	Positive Displacement Blowers	Gardner Denver	Provides motive air for pressure up to 15 psi and vacuum up to 15 inches Hg.
BLWR	Positive Displacement Blowers	Tuthill	Provides motive air for pressure up to 15 psi and vacuum up to 15 inches Hg.
BLWR	Motors	Barr-Thorp Electric / Regal-Beloit	Industrial grade, High-Efficiency Gear Motors
BLWR	Silencers	Stoddard	Provides noise attenuation, mounted at the discharge (bottom) of the blower package
BLWR	Relief Valves / Check Valves	Pathfinder Systems	Provides safety relief and backflow prevention for the blower package
BLWR	Blower Packages	Coperion K-Tron	Blower package design and production
MCC	Motor Control Center	Rockwell Automation	Intelligent Motor Control, allows monitoring and tracking of amperage and time of use for each motor. Includes variable speed control for some motors.
OUTDOOR - NORTH SIDE			
SILO	Storage Silo	CST Industries	10' diameter x 62' tall. Provides receiving, storage, and gravity discharge of up to 3420 cu.ft (100 cu.mtr) of material.
SILO	Bin Vent Filters	Coperion K-Tron	Located at the top of the tank. Provides air filtration, with automatic continuous cleaning, to separate materials from the silo's incoming air stream
SILO	Vibrating Bin Discharger	Carman Industries	Located at the bottom of the tank. Induces gravity flow for hard-to-discharge materials
DC	Dust Collector and Ducting	Airlanco	Provides air filtration, with automatic continuous cleaning, to separate dust from the Full Scale Lab's exhaust air system. Ducts draw fugitive dust away from the equipment and operators, into the Dust Collector
DC	Fan	Airlanco	Provides motive air for the dust collection system.
DC	Explosion Vent Panels & Isolation Valves	Rembe	Provides a safe exhaust and isolation in the event of a dust explosion in the dust collectors.
AIR	Compressed Air	Gardner Denver & Coperion K-Tron	3 Air Compressors and Dryer located in the Assembly building 300 feet west. Variable speed compressor provides the efficient supply under varying conditions. 6" underground pipe provides air supply to the Air Tank on north side of Full Scale Lab.
OUTDOOR - WEST SIDE			
DC2	Dust Collector and Fan	Coperion K-Tron	Provides air filtration, with automatic continuous cleaning, to separate dust from the Lab's exhaust hoods
DC2	Ducting	Nordfab Ducting & ChaDa Sales	Ducts draw fugitive dust away from equipment and operators in rooms 117 & 118, and into the dust collector