## Evaluation of Australian Sealed Silo Technology Under U.S. Conditions

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**Goals:**
1. Document and evaluate the materials and methods used to sufficiently seal a U.S. hopper silo for effective fumigation of stored grain insect pests.
2. Demonstrate and evaluate the gas-tightness of a sealed U.S. silo using the standard pressure half-life decay time test.
3. Evaluate sealed silos for pest control. Quantification via bioassays with resistant insects, probe traps, and fumigant concentration levels.
4. Evaluate sealed silo for grain quality management. Quantify grain quality via samples taken quarterly and tested for moisture content, milling and baking quality, mold and mycotoxins, insect pests, and grading by FGIS grain standards.
5. Validate the KSU 3D Ecosystem model for the scaling-up and adoption of thermosiphon recirculation in larger silos.

**Statement of Problem:**
Sealed storage is an effective technology that helps ensure successful grain fumigations where stored product insects are a concern. Further research is needed to optimize its design and implementation. Fumigations in insufficiently sealed structures have been cited as the main reason for control failures which can lead to insect resistance. A sealed structure keeps the fumigant within the grain mass long enough to achieve a complete kill of insects and prevents populations of resistant insects from developing. Strong resistance to phosphine, a popular fumigant, has recently been found in the U.S.

Sealed grain storage was the subject of much research and development in Australia in the 1970s and 1980s, largely in response to phosphine resistant insect populations found in grain stores. Grain producers and processors needed a means to effectively kill grain insect pests without leaving pesticide residues on the grain.

Australian sealed silo technology will be evaluated under U.S. conditions (Kansas) where it will be subject to hot summers and below freezing temperatures in the winter. For fumigant dispersion within the grain mass, thermosiphon recirculation will be evaluated and compared to fan-assisted closed loop recirculation. Fumigation trials will be carried out with phosphine tablets, cylinderized phosphine (VaporPhos), cylinderized sulfuryl fluoride (ProFume), and chlorine dioxide.

This project will generate new knowledge that will improve stored grain best practices and extension information for grain producers and bulk handlers. It will help in providing pest- and pesticide-free grain while ensuring the continued viability of phosphine.

**Current Activities:**
Reviewing published literature on the subject of sealed grain storage, fumigation, and stored grain quality management. Planning for assembly and sealing of grain bins, installation of data gathering equipment and fumigation equipment.