INVESTMENT PROJECT

Chemical fumigation of grain in vertical grain storage facilities without moving the grain using the automated robotic device SGFOne – a self-immersing in grain fumigator!

Project goal: Robotization and automation of complex technological processes, improved occupational safety, reduced environmental risks, cost-effectiveness, and increased speed of the technological process.

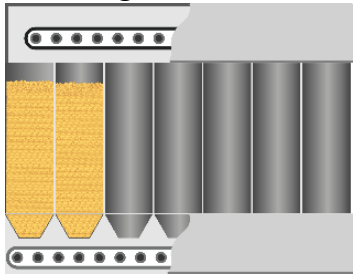
Implementation of safe technologies that reduce costs and improve the preservation of global food supplies.

Advantages: economic, environmental, technological, improved occupational safety and environmental protection, automation and robotization.

Introduction

Grain storage facilities can be horizontal (single-storey warehouses) or vertical (silos made of reinforced concrete or metal).

This project will focus on chemical fumigation of vertical grain storage facilities.



Vertical grain storage facilities (silos) are the most technologically advanced and offer the highest productivity. Vertical grain storage facilities (silos) are the most common worldwide. Grain storage heights typically range from 6 to 30 meters.

Grain silos (vertical grain storage systems) are grain storage systems that provide infrastructure for storing large volumes of grain and other bulk agricultural products. The main purpose of silo (vertical) grain storage facilities is to protect and preserve grain from adverse environmental factors, including pests.

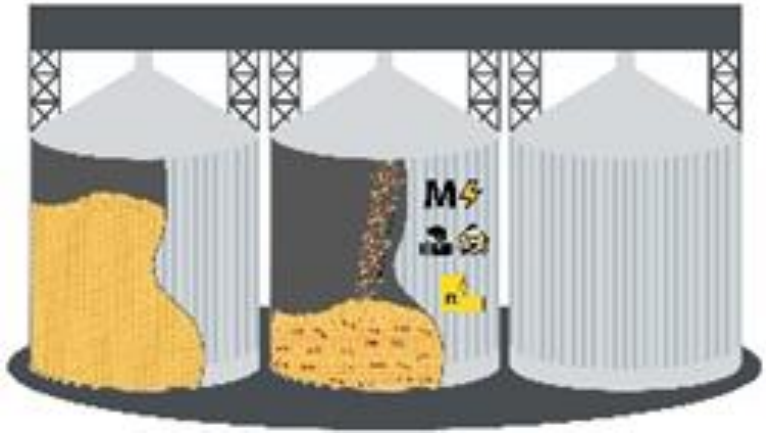
World grain production is steadily increasing, as are global food production and consumption. Storage of food grains is an integral part of the agricultural system, and the preservation and storage of grains should ensure food security for humanity. The growth rate of new vertical grain storage construction is expected to increase by more than 5% per year. Vertical grain storage facilities (grain silos) take up less space than horizontal ones, which is expected to contribute to the growth of vertical grain storage capacity in the coming years.

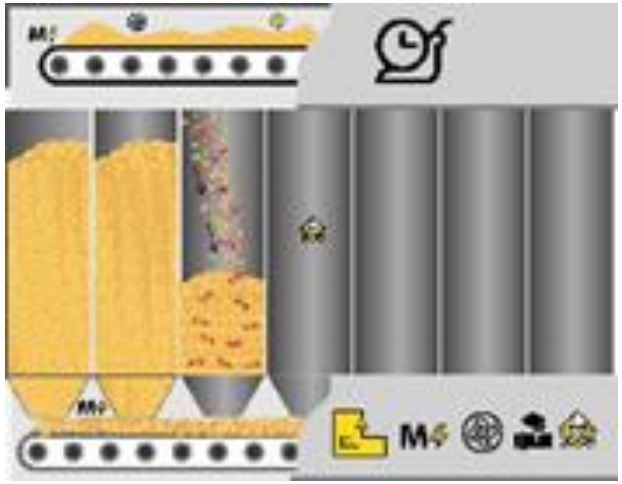
North America and Asia Pacific are expected to hold the largest share of the global vertical grain bins and silo-type grain storage systems market by 2033. The world's top-priority agricultural crops in vertical grain storage are: rice, wheat, corn, soybeans, sunflower, and other crops.

Fumigation—the control of grain pests—is an integral part of grain storage. Fumigation volumes will be taken into account as grain storage volumes increase worldwide.

Chemical fumigation of grain during storage and transportation remains the most common and accessible method of protecting grain products in the global grain industry.

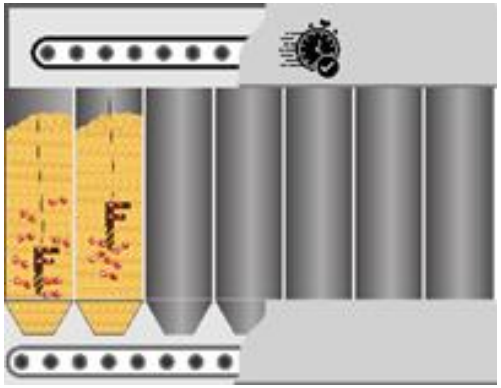
The essence of the project:

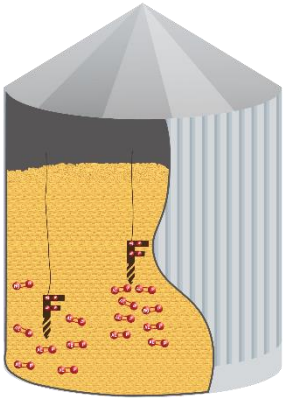




Traditional chemical fumigation of grain stored in silos (vertical) is carried out by pumping the grain from one silo to another, during which phosphides (fumigants) are added to the grain.
Traditional fumigation method:
1) **energy-intensive** – requires the use of elevator equipment to move grain, 2**) labor-intensive** – requires the involvement of labor personnel at the grain storage facility to service the grain pumping and fumigation processes, 3) **Slow** – the intensity of fumigation is limited and proportional to the speed of grain movement by elevator equipment, 4) **Unsafe** (Dangerous)– diffuse phosphine gases are inadvertently spread during the fumigation process throughout the building and into the surrounding area, 5) It is not possible to fumigate a single point of the source of infection in the grain.

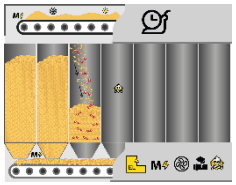
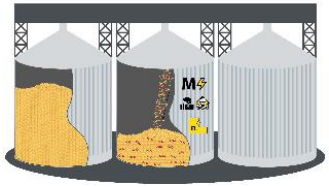
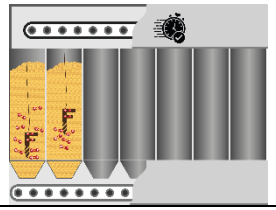
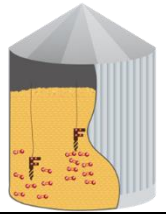
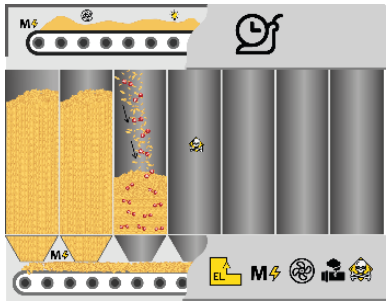
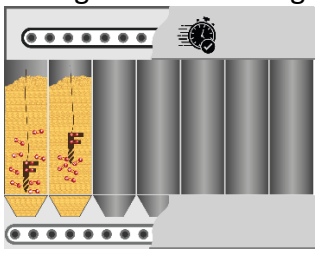
An alternative innovative fumigation technology (SGFOne) proposes to fumigate stationary grain in a filled silo (grain bin).
The SGFOne self-immersing grain fumigator automatically lowers into a grain silo filled with grain and unloads phosphides at a specified point or layer by layer throughout the grain.

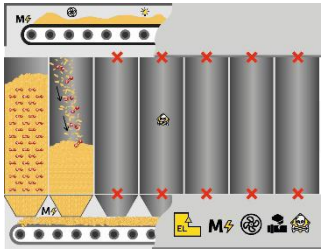
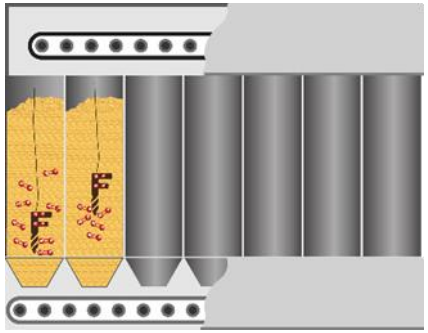
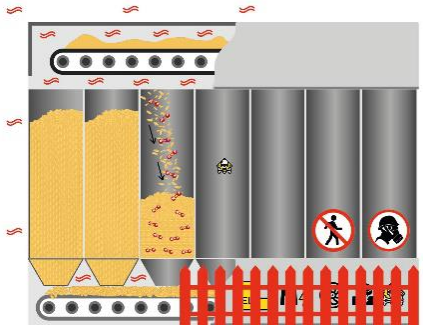
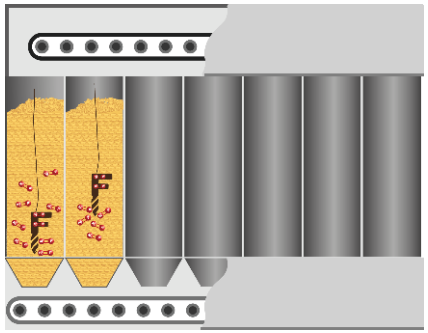


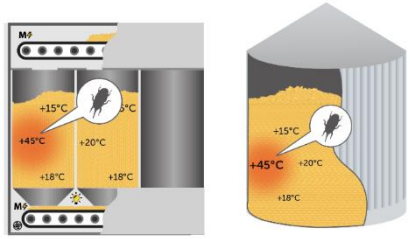
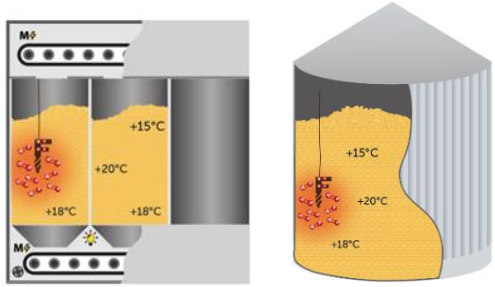
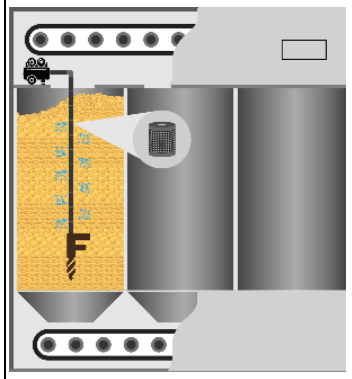


There is no need to move grain (there is no labor cost for grain storage personnel and no energy costs due to the operation of elevator equipment), there is no diffuse spread of gases beyond the grain (environmentally safe), very fast – the SGFOne moves across the height (depth) of the grain storage facility much faster than it would take to pump the grain from silo to silo. Cheaper - the cost of SGFOne fumigation is much less.

A comparison of two grain fumigation methods in vertical grain storage facilities. Disadvantages and advantages.

	The traditional method of grain fumigation involves moving the grain from one grain storage facility to another.		SGFOne method of fumigation of stationary grain, without grain movement
	Description of the process, disadvantages of the method		advantages of the method
1	Full or partial movement of grain for fumigation is accomplished using elevator mechanisms and equipment. Energy consumption of elevator equipment and labor costs are considered to be a part of the technological process.	  Economic disadvantages: - Energy costs associated with the operation of equipment, mechanisms, and lighting. - Labor costs associated with maintaining personnel to support the process.	Very economical: no energy consumption by the grain storage facility, no need to move or lower the grain level in the silos (bin), no need to operate energy-intensive elevator equipment, no personnel required to maintain the grain storage facility during fumigation.  
2	Long-term fumigation of grain in silos is associated with the use of other elevator systems and mechanisms, time spent on moving or lowering the grain and reloading it into the silo, during which phosphides are simultaneously loaded into the grain layer by layer.	 Economic disadvantages: The duration of grain fumigation by the layer-by-layer addition of phosphides to the grain in the silo is determined by the sequence of technological operations in traditional fumigation technology and is proportional to the speed of grain movement (loading of grain into the bin).	Very fast. No more moving grain: the grain fumigation rate in the silo is proportional to the vertical movement of the SGFOne Self-Loading Grain Fumigator within the grain. And on average from 200 tons of grain/hour to 900 tons of grain/hour.  Savings in production time and man-hours spent on fumigation up to 10 times. The SGFOne average vertical movement speed between layers of wheat grain in a silo is 1 meter per minute. For example, the SGFOne can traverse a 30-meter-high silo in both directions (a 60-meter journey) and discharge phosphides layer by layer at specified points on average in 1 hour. Thus, for a vertical silo of a reinforced concrete grain elevator with a height of 30 m, the grain fumigation rate is 200 tons per hour. And this can be achieved with just one SGFOne device! Or a 20m high, 18m diameter metal grain bin with a grain capacity of 5,000 tons, three SGFOne Self-Sinking Grain Fumigators will fumigate in less than 6 hours, with an average fumigation rate of 840 tons per hour.

3	Downtime of the entire silo building of the grain storage facility, even those tanks in which grain fumigation is not carried out. Restrictions on the operation of the entire grain storage facility.	Economic disadvantages: Vertical reinforced concrete grain storage facilities typically consist of 50 or more vertical tanks. When fumigating grain in individual tanks, the entire grain storage building is used  during grain pumping to lower the grain level in these individual tanks, and phosphine gases are distributed throughout the vertical grain storage facility by diffusion. Thus, performing other technological operations, even with unfumigated grain, becomes impossible. Fumigation of individual tanks (bin) establishes a quarantine for the entire grain storage building. Selective, safe fumigation of individual grain tanks using traditional chemical fumigation methods is impossible.	Now there will be no downtime for adjacent and neighboring tanks located in the same silo building. Because the grain remains stationary and the phosphide fumigants are carefully delivered directly to the target point within the stationary grain in a single bin (other tanks and elevator systems are not involved), diffusion does not extend beyond the single fumigated bin. 
4	There is an involuntary spread of phosphine gases (up to 20%) due to wind diffusion beyond the grain storage silos of the elevator due to the continuous movement of grain and the open loading of phosphides into the grain (via conveyor or through hatches).	 Environmental risks, industrial hazards: Phosphine gas leakage into other production areas of the facility (upper and lower galleries), into the outdoor area of the facility, and into the surrounding environment.	 Environmental risks are minimized, there is no grain movement, very precise delivery of phosphides inside the stationary grain, no diffusion of phosphines outside the grain bin.

5	During short-term storage of grain, sometimes focal fumigation of a separate section (layer) of grain is required where a concentration of pests has been noted, revealed by an elevated grain temperature at a certain depth.	 Economic disadvantages: Fumigation of a single source of infection in a grain storage facility is impossible due to the technical impossibility of delivering the fumigant to a separate, designated point within a single storage capacity without moving the entire volume of grain in that storage capacity.	 With SGFOne you can selectively fumigate electively only one point in the grain, at any depth (height) of the silo,it is possible to fumigate only the source of infested stationary grain in the grain bin. This is precisely what the Fumigation of Grain at Given Coordinates Method is all about.
6	Loosening and aeration of grain is an important process that prevents spoilage, helps reduce humidity and temperature, and prevents mold formation and self-heating of the grain. Technically, this is achieved by supplying air to the grain storage facility using special equipment or by moving grain from one silo to another, which requires additional energy and labor costs.	Economic disadvantages: Loosening and aeration of grain is a separate technological process that requires the use of additional energy-intensive elevator equipment, as well as technological time and labor costs.	The self-immersing grain fumigator SGFOne, when passing through the thickness of the grain for fumigation, spontaneously loosens the grain in the silo bunker over a radius of 1.5 m along the trajectory of vertical movement.  An additional function of the SGFOne is aeration of the grain in the silo bunker. The SGFOne can be optionally equipped with an air duct, which is a set of perforated aluminum-magnesium alloy pipes connected to each other with special quick-release couplings for aeration of the grain during immersion of the SGFOne for fumigation. If necessary, the self-immersing SGFOne fumigator can insert an air duct (which passes through the grain along the vertical trajectory of the SGFOne path) into the grain to a depth of up to 30 meters. By connecting an air compressor to the air duct, the grain in the silo is aerated by forcing air into the air duct, thereby distributing the air under pressure in deep layers of grain in a silo bunker. Aeration of grain during fumigation is an additional function that requires additional time.

7	High cost of outsourced fumigation services and high labor intensity of fumigation works	Economic disadvantages: High cost of fumigation services.	The use of robotics and automation - the SGFOne self-immersing grain fumigator will reduce the cost of grain fumigation in vertical grain storage facilities by 25% -30%. +Take into consideration the savings in electricity, time and labor costs of the grain storage facility itself.

The innovative robotic device SGFOne has been in development for several years, and technical documentation for serial production and patenting is currently in the final stages.
As early as March 2026, we will introduce the world's first automated and robotic self-immersing grain fumigator, the "SGFOne." And in June-August 2026, SGFOne will enter small-scale production.
SGFOne devices are expected to be available for international sale under a franchise model as early as August 2026, when the Northern Hemisphere grain storage season begins.

In 2026 alone, we (through accredited Franchisors) plan to fumigate over 1 million tons of grain in silos (vertical) grain storage around the world and sell over 100 SGFOne self-loading grain fumigators worldwide.
In this timeframe (2026), the global grain industry could save an average of over 200 megawatts of electricity and over 10,000 hours of production time and man-hours on chemical grain fumigation by using SGFOne.
In 2027 – three times more.

Certainly, the alternative innovative method of motionless grain fumigation using the SGFOne system will take a smaller share of the global use of vertical grain silo fumigation compared to the widespread traditional method of grain movement, which cannot be completely abandoned in the global grain industry.
But taking into account the economical, environmentally friendly advantages, technological advancement and safety of the SGFOne fumigation method, by 2030, we plan to cover the entire global grain storage market and occupy a share of at least 1% of all vertical grain storage facilities worldwide and up to 20% of outsourced fumigation service operators worldwide that will use SGFOne fumigation technology and equipment.

The franchise sales model was chosen to control equipment buyers, technical service, leakage of patented technical and technological components, and analysis of the fumigation work (services) consumption market.

Financial part of the project upon request.